FARMERS DIGEST

RECEIVED
MAR 24 1939
U. S. Department of Agriculture

APRIL, 1939

Volume 2
No. 12

25c a Copy
$2.00 a Year

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The Farmer's Digest

From more than two hundred magazines and bulletins published in this country and abroad, the Editorial Staff of the Farmer's Digest selects articles of outstanding merit and general interest. It is comprehensive in its scope, covering all phases of Agriculture.

The Farmer's Digest

Published monthly at Ambler, Pennsylvania

25c a Copy *1 Year $2.00*

2 Years $3.50 *3 Years $5.00*

Foreign Subscription $3.00 a Year

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Entered as second-class matter at the Post Office at Ambler, Pa., May 8, 1937, under act of March 3, 1879

The Farmer's Digest

Vol. 2 April, 1939 No. 12

All-Purpose Supplement

Condensed from Successful Farming

Paul Gerlaugh

Ohio Agricultural Experiment Station

FEEDING steers, dairy cows, hogs, hens, and lambs from the same protein supplement bin may seem strange to a lot of folks, but we have done it with excellent results.

Such a statement may not be of much interest to the man who keeps only one class of livestock, but the farmer who keeps two or more classes of livestock and poultry will be interested because it simplifies his feed problems. The protein problem is the most important one on many, if not most farms. This statement becomes increasingly true as we enter the Cornbelt, because corn, more than any other widely grown grain, needs additional protein if satisfactory feed-lot results are to be obtained.

The trend toward lighter-weight meat animals is usually explained as being the result of consumer demand. There is considerable doubt if desirable lightweight market animals could be produced without protein supplements. In other words, the coming of protein supplements has made possible the finishing of meat animals at lighter weights.

Linseed meal was the first of the protein concentrates to come into the Cornbelt territory. Cottonseed meal soon followed linseed meal. About this time tankage found its way into feed channels for use by the hog and poultry folks. All of these feeds and others too, especially gluten meal, became standard feeds for use in making balanced livestock rations.

It was a most constructive period in livestock feeding when it was realized that the investment in additional protein was well worth while. It still is a major investment, altho the science of nutrition has found much about the importance of additional minerals and vitamins for many rations.

As more farmers become interested in using protein supplements, some of them raised the question as to whether they could

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grow their own protein concentrates in the form of soybeans, and soon soybeans for grain increased rapidly in acreage. They developed into a major crop, and the processors of soybeans became numerous enough and the oil of sufficient value so that beans could be traded for meal and both the processor and the feeder be ahead.

About 10 years ago we had many cattle-feeders raising the question as to the advisability of growing soybeans for use in cattle-fattening rations. Some experiment stations were already working on the problem.

Tom Johnson was feeding several hundred head of steers annually on his farm of some 2,000 acres just west of Columbus, Ohio. Both Johnson and his manager, Paul Hackett, were interested in growing soybeans for use as a protein concentrate in cattle-fattening rations if they would give the results that they had been getting with cottonseed meal.

Arrangements were made with Mr. Johnson and Mr. Hackett to conduct a feeding test, using 100 yearling steers in each of 4 lots. One lot was to get linseed meal, one lot cottonseed meal, one lot whole soybeans, and the fourth lot a mixture of equal parts of each of the three. Silage, legume hay, and corn-and-cob meal made up the remainder of the ration. The same amount of each of the feeds was to be fed to all 4 lots. We realized there was a difference in the protein content of the various supplements, but we wanted to feed the same amounts for other reasons.

The test was not under way very long before Paul Hackett called and said that the Lot-4 cattle, fed a mixture of supplements, were cleaning up their feed more quickly than the other lots and asked whether they should be favored by giving them more corn. This was not done until near the close of the test. They were then given more corn than the other lots, and they took it.

This test certainly showed the advantage of using a mixture of linseed meal, cottonseed meal, and whole soybeans over either one of them alone, but it did not explain why.

Our nutrition division told us they were sure that the explanation was in the improved quality of protein in the mixture. They explained that the amino acids are the fundamental part of proteins. There are some 2 dozen amino acids known at present, some more essential than others. Linseed meal has a different amino-acid content than does cottonseed meal or whole soybeans. The same can be said of cottonseed meal and soybeans. When we mixed the 3 feeds we obtained a preferable amino-acid content

in our supplement; hence more desirable results.

Well! If this line of thought works out with the vegetable proteins, what would happen if we added tankage to the mixture? We would be adding some new amino acids and doubtless further improve the quality of the supplement. Will cattle eat a mixture containing tankage? We did not know, but figured that if fat steers would in hot weather, we need not worry about thin steers or cool weather. We soon found out that steers would eat 2 pounds of either dry-rendered or digester tankage a day and raise no questions.

That fall we mixed linseed meal, cottonseed meal, and dry-rendered tankage together in equal parts and fed the mixture at the rate of 1.6 pounds daily per calf, in comparison to 2 pounds of a mixture of equal parts of linseed meal and cottonseed meal to another lot. The silage, hay, and corn were the same for both lots. So was the quantity of protein in the supplement. The higher protein content of the tankage made for the feeding of a smaller amount of supplement in order to supply the same amount of protein. Remember that there would be carbohydrate and fat in the supplement as well as protein, and there was .4 of a pound less supplement per calf per day.

At the end of 40 weeks, the calves getting the mixture containing the tankage had gained 39 pounds more per calf than the other lot, and they wanted more feed all the time but did not get it. The addition of the tankage was well worth while in cattle-fattening rations, but it did raise some questions which we thought worthy of consideration.

Where were we to get the tankage? It is a by-product, and most of the supply already was going into hog and poultry rations. However, it had been shown that a mixture of meat scraps and a vegetable protein was as satisfactory or even preferable to meat scraps alone for either hogs or hens.

Why couldn't a mixture be made that would enable the cattle folks to trade some of their vegetable protein to the hog and poultry folks for some of their animal protein, and both parties be ahead? And so the men of the Animal Industry Department sat down together and worked out a formula for a supplement to be used for the various classes of farm livestock.

The formula consisted of tankage, 30 parts; soybean oil meal, 30 parts; cottonseed meal, 20 parts; linseed meal, 15 parts; finely ground limestone, 2 parts; special-steamed bone meal, 2 parts; and salt, 1 part. We realize there is no one best mixture, because of price fluctuation from

season to season and from one territory to another.

We took this mixture and fed it to steer calves in comparison with a mixture of linseed meal and cottonseed meal, giving both lots all the corn they wanted, and, at the end of 40 weeks, *had 52 pounds more gain per steer.*

S. M. Salisbury, in charge of the dairy work at Ohio State University, took some of the supplement and fed it along with corn and oats to a group of 10 cows in comparison with a similar number fed the regular University ration, and after a double reversal test the two groups were in a dead heat—about 150 pounds difference in the milk produced by the 2 groups of cows in 4 months. That difference favored the all-purpose supplement group. Later work done in the herd at the Mansfield Reformatory showed the same results.

Mr. Kennard took the supplement and fed it, along with alfalfa hay in a rack, to laying hens and got fine results.

Mr. Robinson found that this supplement and alfalfa fed in a rack to pigs gave as good results as the trio mixture.

Mr. Bell used the mixture for fattening lambs and found they outgained the check lot, altho maybe not so well finished at the end of 112 days.

We were all very much pleased at the way things were turning. The real test was still ahead. What would this do out on John Jones's farm? We chatted with some of our farmer friends about trying it and they did. And it worked well there.

We should like to make it clear that there is no one best mixture. The one we have mentioned is a good one, but we don't feel it is the only good one. Due to change in relative prices, we have reduced the tankage to 20 percent of the mixture in some cases and in some other cases we have used only 2 of the vegetable proteins. We think we know that a mixture of proteins, several animal and vegetable proteins, is preferable to any single one; and it seems that the nutrition of our various classes of livestock is sufficiently similar so that the same supplement will do surprisingly well for all of them, and probably make some saving in doing it.

Good "Doers" Make Good Milkers

Condensed from The Ayrshire Digest

C. L. Clevenger

Livestock Superintendent of Mt. Hope Farm, Williamstown, Massachusetts

THE 'good doing' calf usually makes the best producing cow (provided she is also bred for milk)," is the opinion of C. L. Clevenger, popular and efficient livestock superintendent of the Mt. Hope Farm, of E. Parmalee Prentice, Williamstown, Massachusetts, who for several years has been making a study of the relationship of growing costs to subsequent milk records on nearly fifty dairy heifers that have been raised at Mt. Hope.

Posted conspicuously in the barns at Mt. Hope are the costs per pound of gain of every heifer that has been raised at this well known establishment, and in the characteristic Mt. Hope manner, the production of these same heifers is also recorded. The entire report has been charted and shows that the heifers with the greatest costs per pound of growth are usually the lowest producers, and conversely, the heifers that make cheap growth are usually the heaviest producers.

"And why shouldn't they be?" is Clevenger's attitude. "Making milk in large quantities depends on efficient use of feeds; making growth economically also depends on efficient use of feeds.

"Someday we are going to appreciate better than we do today that making efficient use of feed is one of the most variable factors in our livestock population. In fact, there may come a time when we shall cull a lot of our livestock early in life, just as soon as we find out more about their rate and efficiency of gains."

Mr. Clevenger then went on to point out that the heifers that had cost from 26 cents to 28 cents per pound to grow, produced 600 pounds or less of butterfat under the special care given them at Mt. Hope. Those whose cost of gains ran from 17 to 20 cents per pound produced an average of about 900 pounds of butterfat, with production in each case figured to maturity, on three milkings daily, and lactations of 365 days.

The possibility of being able to predict the approximate level of production of a heifer based on the food required to raise her to,

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say six or nine months of age, does not seem at all unreasonable.

In Sweden, the culling of pigs is done when they are about three weeks old. After weighing and measuring thousands of pigs, the Swedish investigators learned that the rate and cost of gains during the first three weeks were quite accurate forecasts of how the young pigs would 'do' in later life, and—why continue to feed them unless they have made economical gains?

In the Record of Performance that has been established by swine breeders in this country, which requires that litters of pigs must be weighed at stated intervals, it has been found that the weight at fifty days is quite an accurate measure of what may be expected later. Mr. Clevenger pointed out that in order to make this plan effective, heifers must be raised under uniform conditions, and that uniform feed costs must apply over a period of several years.

The scale of feed charges at Mt. Hope was arbitrarily adopted during the period from 1925-29, and is considerably higher than it would be based on present-day values. The present Mt. Hope schedule of charges is as follows:

Grain ration	$50.00 per ton
Hay	24.00 per ton
Silage	10.00 per ton
Whole milk	.06 per quart
Skim milk	.03 per quart
Pasture	3.00 per month

Heifers are expected to make a growth of 600 to 700 pounds in one year.

The grain ration that has been favored at Mt. Hope consists of the following:

1200 pounds of crushed oats
300 pounds of cracked corn
300 pounds bran
200 pounds of oil meal

In commenting about feeding calves, Mr. Clevenger stated that four-months old calves are fed just the amount that they will clean up in twenty minutes or half an hour, which usually ranges from 2½ to 4 pounds each. A twice-a-day feeding schedule is followed. From four months until a year old, 5 pounds of grain are fed daily.

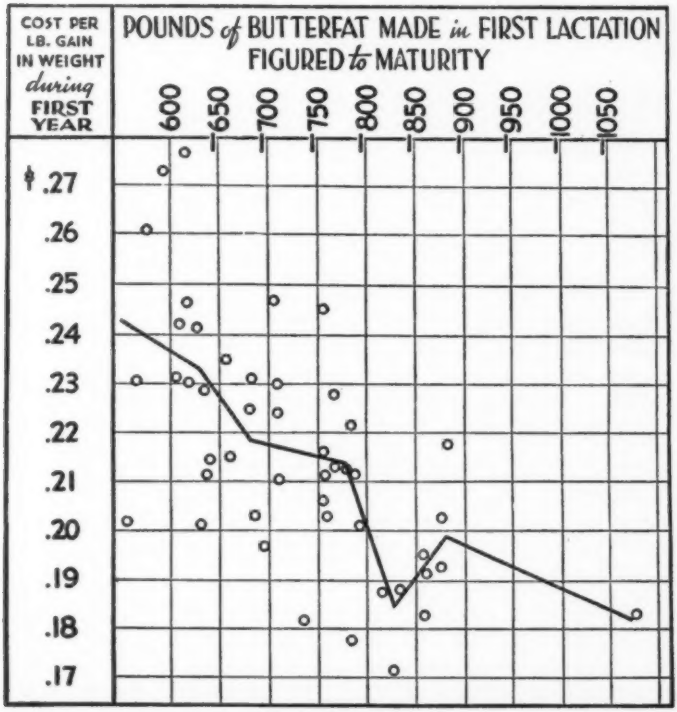
Methods of feeding were described by Clevenger as follows: "We give the calves mother's milk for three days, when they are then moved to the calf barn. At the end of the week, they are getting whole milk. When six weeks old, we put them on skim milk. There is plenty of skim milk available at all times. We start out by feeding 1 pound of milk per 10 pounds of body weight, at body temperature. The calves are put in individual calf stalls when eating, and allowed to run together out of doors after they reach a year of age."

When asked the cost of raising heifers at Mt. Hope, based on the

above charges and methods, Clevenger stated that a group of twenty heifers had cost $113.50 at twelve months, and $187.41 at two years of age. Mr. Clevenger also pointed out the necessity of good roughages.

When asked if there were any new plans for investigations along this line, Mr. Clevenger told of work that has been started in studying the growth costs of bulls and the production of their daughters. "Someday," he added, "we will probably attach a lot more importance to the characteristic of ability to make efficient growth in all of our livestock. Producers of meat animals have long recognized it, but it is just as important for dairy cattle breeders."

CHART SHOWING COSTS OF GROWING HEIFERS COMPARED WITH THEIR PRODUCING ABILITY



Note: All costs have been figured on a uniform basis. Heifers are raised at Mt. Hope Farm under as nearly uniform conditions as can be provided, over a period of years. All records are 365 days in length, are made on three milkings daily, and are figured to a mature equivalent.

Tempering the Wind with Trees

Condensed from Kansas Farmer

IT is tree planting time on the Plains again. Fifty to seventy-five years ago, as Central and Western Kansas were settled, farm owners planted trees. They were not always set in the right places, but the work was done, and enough of the trees grew to give Kansas a picturesque and protective sprinkling of windbreaks and groves.

Drouths have had a lot to do with the disappearance of these farm groves in recent years, but there is another reason. Most of the groves have lived out their life span. So it's tree planting time again.

There is no get-rich-quick side to tree planting. Many times the person who plants the trees does not reap the major benefit. But there are definite financial gains to be expected.

Just as soon as a windbreak or shelterbelt is well started on a farm, it increases the value of the land. In less than 5 years a strip of trees will be breaking the wind. In 10 years the efficiency will be nearing its peak, for the quick growing trees will be 20 to 30 feet tall. After that the conifers—evergreens, cedars, and pines—will be reaching their maximum height, and they will be "good" for a lifetime.

Trees won't grow just anywhere, even in the sections where they are generally adapted. But they will grow in any section of Kansas if they are given the benefit of rainfall, drainage, good soil, and proper tillage.

The shelterbelts put out by the Forest Service over counties of Southwestern Kansas have proved many things. The things that have been shown are that clean cultivation is necessary for seedlings as long as it is possible; that shelterbelts in long strips are more valuable and just as easy to grow as the more common groves planted 50 years ago; that a mixture of trees should be used, to provide a succession of protection, beginning right away.

Clean cultivation between the rows of young trees is all important. Two years ago we saw a striking example of this, where trees in a shelterbelt had grown far over one's head in two dry seasons.

A planting of trees will not take care of itself any better than will a crop of corn. Weed growth is rapid and weeds deprive the

Reprinted by permission from the Kansas Farmer, Jan. 14, 1939

trees of soil moisture they badly need. Cultivation eliminates weed growth and leaves the ground in proper condition to absorb rainfall.

Of course, winter winds will blow dust from a shelterbelt if there is no surface protection, so it is good practice to seed a late summer crop of oats or cane which will freeze out but offer winter protection.

Shelterbelts in long strips fulfill the name. They break the wind and offer protection to growing crops along both sides of their entire length. It is estimated that 8 acres of trees planted in this fashion will protect 160 acres. Some of the low growing trees, such as Russian olive and tamarisk are planted on the edges of the windbreak. These prevent the wind from cutting underneath the taller trees. Next come such trees as Osage Orange (hedge), Chokecherry, Red cedar, pines, and Chinese elms. At the center are the tallest growing trees. Cottonwoods, before they become too huge, should be cut back or taken out, so that their removal, altho many years from now, will not result in crushing the lower growing trees. Red cedar is the popular favorite for windbreaks, but of course, it takes many years to mature, and its development may not only be aided, but its effect supplemented by using some of the trees which grow quicker, shed their leaves in winter, and have a shorter life.

Taking run-off water into the windbreak will give the small trees an extra advantage. Hundreds of farmers are doing this by the aid of ditches or terraces, but thousands have overlooked the opportunity. It is better to have a live, thriving windbreak in a low area, than a ghost of a shelterbelt on a rise.

A Forest Service release states: "Much of the trouble experienced by tree planters in the Plains region may have been caused by use of planting stock derived from improper seed sources. In our shelterbelt planting program we always have been careful to use stock in any given locality produced from seed obtained locally or from regions of comparable climate."

Work by the Forest Service in the Plains region has shown it is folly to plant under-size seedlings if rapid growth is desired. Diameter of the trees is the important factor, rather than their height. A seedling which measures well up to ¼ inch in size at 2 inches above the ground line is considered large enough. Trees under ⅛ inch in size had a survival of 5 to 40 per cent, while those from ¼ to ½ inch survived 75 to 99 per cent. The matter of diameter of the seedling is not a matter of age, but of vigor and quality.

Egg Auctions Prove Their Value

Condensed from Everybodys Poultry Magazine

Lester Hartwig

NO longer is the chant of the egg and poultry auctioneer strange in many communities in northeastern states. After eight years, poultry and egg auctions have become a permanent reality and the sing-song of the auctioneer's voice a common sound to producers and buyers alike.

Back in 1930 when the first co-operative egg and poultry associations were organized in New Jersey, many were skeptical concerning their chances of success. Since the two pioneer organizations were formed at Toms River and Flemington, N. J., this type of association has come to occupy a place of tremendous importance in the marketing of northeastern poultry and eggs.

That they have been a success from the start is indicated clearly by their almost stupendous growth. Consider that in 1930, two associations having 350 members handled 13,510 cases of eggs. During 1937, 22 associations sold 991,414 cases of eggs and 172,314 crates of poultry for 13,068 members.

In Pennsylvania, egg auctions and other co-operative organizations now provide an outlet for producers in half the 67 counties in the state. The organizations are of particular benefit to poultrymen in the 35 surplus producing counties whose eggs must be disposed of in underproduction areas.

Bucks County, Pennsylvania, is a typical example of a community served by an egg and poultry auction. Doylestown, the county seat, is located about 30 miles from Philadelphia and less than 100 miles from New York City. It is a centrally located trading center for the county. Before the Bucks County Producers Co-operative Association began selling eggs by the auction method on July 13, 1931, most of the county's producers either sold their eggs to door-to-door hucksters or shipped direct to buyers in nearby cities.

Previously, it was necessary for the hucksters to gather their supplies in one or two days and spend the remainder of the week retailing to city or suburban customers. They welcomed the formation of an organization from which they can obtain easily the quantity and quality of product required for their trade.

Visiting an egg and poultry

Reprinted by permission from Everybodys Poultry Magazine, Feb., 1939, Hanover, Penna.

auction is a novel and educational experience. At Doylestown, the egg auctions are held on Monday and Thursday afternoons. The producer grades his eggs according to size and color and delivers them to the auction building. Where several producers live in the same community, usually one of the members delivers all the eggs for a small charge. On delivery, the producer is give a receipt.

An inspector, licensed by the Pennsylvania Bureau of Markets, checks at least 100 eggs in each case and establishes a classification or grade. The rapidity and deftness with which he handles the eggs in making his inspection is amazing. There is no lost motion, and the job of inspecting a case is a matter of moments.

Very seldom are many producers present at the time of sale. A licensed auctioneer is in charge, and the eggs are sold to the highest bidder. Each producer's eggs are sold separately. The auction protects itself by using a stop-loss bid which is usually several cents under the prevailing market price for a specific grade. In addition to buyers present in person, the auction delegates an individual to purchase for wire and telephone bids of which there are often many. Eggs bought on wire or telephone bids are called for or shipped to their respective purchasers.

"All eggs are paid for with cash or certified check before they are removed from the auction building. On the day following each sale, checks are mailed to the producers," states William Gwinner, manager of the Doylestown Auction.

"When eggs are delivered properly graded as to size, an inspection and sales charge of only 35 cents a case is made. However, there is an additional fee of 50 cents if the inspector must regrade the case, making a total of 85 cents. This handling charge enables the organization to build up a small cash surplus."

The Bucks County Producers Co-operative Association had 28 paid members on the day of its first sale. It now has approximately 700 members consigning 1,000 to 1,800 cases a week. During its first year the co-operative sold more than $200,000 worth of eggs and in 1937 the value passed over the $600,000 mark. The co-operative this year did a $700,000 business at a cost of $28,000. It now auctions live poultry for its members. Slow to take hold at first, this service is providing a profitable outlet for live birds.

One of the leading egg and poultry auction associations in the East is now considering the establishment of a dressing plant with cold storage facilities for the handling of poultry meat. At one time when live Leghorn hens were selling at 12 cents a pound,

the same grade of bird full blood and feather dressed was retailing at 46 cents a pound. They believe that with proper facilities part of this differential can be returned to their members.

Just what has the auction method of selling meant to the producers? Records kept by a member in the early months of the Doylestown market, will best answer this question. Based on the New York premium price for white extras less two cents per dozen, 7590 dozen eggs brought $18.31 more on the auction, even after all expenses had been deducted, than they would have sold to a huckster calling for them at the door.

The gain by selling 9240 dozen mediums by the auction method was $85.42, while returns from 3717 dozen pullet eggs were $74.62 greater. By selling through the auction, $7.44 was gained on 1228 dozen pee wees. In other words, the total gain amounted to $185.79.

However, one point is not made entirely clear by the above report. It so happened that previously all pullet grade eggs had gone to hucksters as pee wees. Therefore, the actual gain on the 3717 dozen eggs sold on pullet grade was $664.23.

"After all expenses were paid, our records showed a gain of approximately 2 cents a dozen in favor of the auction method of selling. We compared auction prices with New York quotations less two cents a dozen," this satisfied patron stated.

The opinion of experts after studying the egg and poultry marketing situation in Pennsylvania is that returns to producers have been increased by one to twelve cents a dozen for eggs of the same quality. This increase also applies to non-members in areas covered by the auction as well as in adjoining counties. Buyers who do not patronize the auctions pay their producers practically auction prices.

Another advantage of the auction system is the extension of the market area. Because large numbers of brown eggs are marketed at Doylestown, buyers are attracted from points as distant as Boston. Many producers prefer breeds laying brown eggs but until a market was developed, white eggs usually sold at a premium because of local preference.

Pre-Farrowing Management

Condensed from The Duroc News

Prof. J. S. Coffey

Ohio State University

MERE numbers of pigs in the total do not answer the problem of adequate production. Rather it is a matter of having large, healthy litters per sow. For instance, production costs are cut radically if the breeder's quota of 100 pigs is produced from 12 sows rather than from 20. At this stage of sow management there is not much that can be done in influencing the factor of numbers. This must be done in brood sow section and through proper management of sow and boar before and during the mating season.

On the other hand, there is much that can be done toward guaranteeing live, healthy pigs at farrowing time.

The normal gestation period for the brood sow is approximately 114 days. During the first 70 of these days the foetus makes only 25 percent of its growth, while in the last 44 days 75 percent of the foetal growth takes place.

A mature sow in thrifty condition should gain at least 50 pounds during gestation and the young bred gilt should gain considerably more. In the former case the gain barely takes care of the foetal development and makes no allowance for gains which will put the sow in top condition for a strenuous period. Therefore, it would be much better to have the mature sow gain more than 50 pounds.

The question of the proper ration for pregnant sows is one foremost in the minds of sow owners. Two factors are of utmost importance. First of all, it is important to have a ration which will properly nourish the sow and her prospective litter, and secondly, the owner wants to get satisfactory results at the least possible cost.

In dealing with the content and character of the ration it is well to keep in mind that bulk is beneficial in the sow's ration providing the feed which furnishes bulk is also valuable in giving the sow needed nutrients. Two feeds which most meet these requirements are oats and alfalfa hay. Many hogmen shy away from corn in the brood sow's diet,

Reprinted by permission from The Duroc News, Jan., 1939

but this is a mistake because corn has been, is still, and will continue to be the leading cereal grain in pork production. The mistake is to feed it exclusively.

A good ration for the pregnant sow, considering the cost and availability of feeds, is as follows:

	Mature Sow	Gilt
Corn	50%	45%
Oats	40%	45%
Soybean Oil Meal	4%	3%
Tankage	3%	3%
Alfalfa	2%	2%
Minerals	1%	2%

In the foregoing rations, soybean oil meal may be replaced with linseed oil meal if the price is such as to justify the substitution. Further it should be said that the equivalent of milk or fish meal for the tankage will not lower the efficiency of these rations.

The mineral part of the ration is particularly important for pregnant sows during the winter, and more so for the gilts. In supplying minerals it is not necessary to purchase the very expensive types. Three to three and one half cents per pound is enough to pay for a complete mineral. If no complete commercial mineral mixture can be obtained at that price, then the following home mix can be used:

Finely ground limestone	40%
Bone meal	39%
Iodized salt	20%
Copperas	1%

The limestone should be of high calcium content, for it and the phosphorus in the bone meal make up the most important part of any mineral mixture. The manufactured mineral, however, has such ingredients as iodine and iron more thoroughly and expertly mixed than can possibly be done by the layman.

Ranking in importance along with proper feeding is the matter of adequate exercise. A surprising proportion of unsatisfactory farrowing time results can be charged to lack of sufficient exercise. In bad weather, in extreme cold spells and when the ground is frozen rough and sharp, there is considerable disinclination on the part of the sows to take what exercise they need. This is especially true as they become heavier with pig and if they are adequately fed. If they do not exercise sufficiently of their own accord they should be forced to it by feeding and watering at some distance from the sleeping quarters. Even then the condition of their bowels should be carefully watched.

As the sows are bred it is well to lot them separately from those which have not yet been mated. Pen mature sows in one place and fall yearling and spring gilts in another. These sows and gilts should be tried out daily with a boar to be sure of catching all those that return for service.

Finally, it seems appropriate to offer some topics as reminders to the sow owner, the neglect of any one of which may interfere with maximum efficiency at farrowing time.

1. Sows should be comfortably housed in quarters which are dry, roomy, well ventilated, and with doors which are big enough and with low door sills.

2. Frequent inspection for lice is important. The louse parasites can be easily eliminated through the external application of crude or other mineral oils. Care should be taken to see that the atmospheric temperature is moderate at the time the oil is applied.

3. Mange is another external parasite which should never get a foothold on brood sows, because it is easily transferred to pigs, and here the results can become serious. One pound of lime sulfur mixed with fifteen gallons of warm water and used as a wash on the mange infested areas on the brood sow should clear up the difficulty.

4. It is a good policy to increase the amount of the ration and the proportion of the protein supplement at the end of the tenth week of the gestation period.

5. Frequent brushing and handling of the sows tends to make them tame and more easily handled at farrowing time.

6. Three or four days before the sow is due to farrow, reduce her daily ration allowance materially, and after farrowing build it to a full ration gradually over a ten day period.

7. As farrowing time approaches, see that the sow is placed in her farrowing quarters several days ahead of her due date, so that she may become accustomed to the change. It is very important, however, to make sure that adequate daily exercise is continued.

8. Follow all the practices advocated in the McLean County system of swine sanitation.

9. Provide guard rails and all other farrowing pen devices to insure against the crushing of small pigs.

10. Be on the job at farrowing time but do not interfere with proceedings unless the occasion absolutely demands attention.

In culling your brood sow herd, don't condemn those individuals that are in poorest condition. At the Beltsville Station, records of 700 sows over a 9-year period indicate that the sows which gained fastest during the gestation period tend to farrow the largest number of pigs. By the same token, these heavier producing sows lost more weight during the suckling period.

Inheritance of Milk Secretion

C. W. Turner

Professor of Dairy Husbandry, University of Missouri

BREEDERS of dairy cattle have improved their herds by two methods, the selection of the best animals to be used for breeding purposes, and the culling of the inferior animals produced by such matings. Where many progeny result from each mating, such as in swine and poultry, severe culling can be practiced and only a few superior individuals are required as breeding animals to maintain the size of the flock or herd. In the case of dairy cattle, the reproduction rate is slow and a large percentage of the heifers raised are required for replacement to maintain the size of the herd. As a result, improvement in the average ability of dairy cattle to produce milk and butter fat has been very slow.

One of the most important contributions of genetic research to the improvement of dairy cattle has been the emphasis placed upon the use of proved sires during the past few years. By the continued use of dairy sires which have already proved their ability to sire daughters who have the ability to produce more than average amounts of milk and butter fat, we have one of the best methods of improvement. No doubt, as this practice becomes more widely used much good will come from it.

Breeders of dairy cattle will be interested in learning of research work now in progress at the Missouri Experiment Station and elsewhere, that holds great promise of contributing to the improvement of dairy cattle. Undoubtedly, as you breed dairy cattle, you have wondered time and time again why some daughters of a bull will be capable of large milk and butter fat production and why others, under similar conditions of feeding and management, produce very little. They may look alike and be of about the same size, yet in some cases they simply do not have the ability to transform large amounts of feed into milk.

In some of the earliest research work done at this Station, the late Professor C. H. Eckles and O. E. Reed, now chief of the Bureau of Dairy Industry at Washington, made a study of this problem. Two half-sisters in the Station herd attracted their attention. One cow produced 3189 pounds of milk and 114 pounds butter fat in a year, while the

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other cow produced 7174 pounds of milk and 377 pounds of butter fat. Several possible reasons for the difference in production were suggested. 1. There might be a difference in the maintenance ration of the two cows. 2. There might be differences in the coefficient of digestion of food by the two animals. 3. The production of body fat by the inferior producer from a portion of the ration given above maintenance. 4. Difference in the amount of food consumed and used in excess of the ration of maintenance.

In this study it was found that the difference in the two cows was not to be found in the differences in the maintenance ration or in the coefficient of digestion. The superior dairy cow was simply one with a large capacity for using food above the maintenance requirement for milk production.

Many studies have since been conducted to try to determine why cows differed in their productive ability. It is said that they have inherited differences, but the inheritance which an animal receives has a physiological basis of expression. The "something" which she inherits has been sought.

During the past few years there has been a great deal of study devoted to the activity of the glands of internal secretion. These glands secrete hormones or chemical substances into the blood stream which are carried to various parts of the body where they act upon organs and glands, stimulating some to growth and others to secretion.

The application of this work to the field of milk secretion is believed to furnish the explanation of the physiological differences between cattle of low and high milk production. The pituitary, a little gland located at the base of the brain about the size of the tip of a finger, is a master regulator of the endocrine glands. It has been found to secrete a number of hormones or chemical substances which have the ability to stimulate the activity of other glands. These hormones pass into the blood stream and are transferred to all parts of the body.

One hormone of the pituitary acts upon the udder of the heifer during pregnancy and stimulates the growth of the inner structure which later manufactures milk. Another pituitary hormone stimulates the cells which have been developed during pregnancy to begin to secrete milk. This hormone is being secreted all during the lactation period. If for any reason the amount of hormone produced declines, then the yield of milk will also decline. It has been found that the pituitaries of beef cattle contain less of this hormone than the pituitaries of dairy cattle. Similarly, the pituitaries of high producing dairy

cattle would be expected to secrete more of this hormone than those of low producing cows.

Recently, it has been shown that many cows do not have available in their system amounts of this hormone sufficient for maximum milk production, for by injecting additional amounts some cows will increase in milk production as much as fifty per cent. This is interpreted as meaning that these animals have not inherited a pituitary which is capable of secreting optimum amounts of the hormone stimulating milk secretion.

This injection of this hormone into cows to determine how they will respond may be a method of determining the inheritance of the cow for the production of this hormone.

Another hormone of the pituitary is called the thyroid stimulator because it acts upon the thyroid gland and increases the secretion of thyroxine. That the amount of thyroxine which is secreted by dairy cattle influences the yield of milk produced, has been demonstrated during the past few years. When the thyroids of milking cows were removed, milk production was decreased by about thirty per cent. When thyroxine was injected into cows during the declining period of lactation, the yield of milk has been increased in some cows as much as ten to thirty per cent. Here again is evidence of the lack of optimum secretion by the thyroid gland and possibly the pituitary gland.

These two examples of the influence of the secretions of the pituitary and the thyroid upon milk secretion indicate how important they are in governing the milk yield of cows. Another gland with which you are probably not familiar, called the adrenal, has been shown by recent work at this Station to secrete a hormone which seems to be absolutely essential for milk secretion, because when this gland is removed or ceases to function, milk secretion soon ceases. It has not yet been shown whether milk secretion will be increased by the injection of this hormone, that is, if the gland secretes less than the amounts required for optimum milk production. It is interesting to note that the secretion of this gland is also regulated by a hormone from the pituitary.

The various constituents of milk are formed from constituents in the blood which flows to the udder. The amount of milk which a cow is capable of forming is dependent upon the amount of these constituents in the blood which can be taken up by the udder. One of the most important constituents of the blood, called glucose or blood sugar, is transformed by the udder into milk sugar or lactose. Every time the

blood passes through the udder of cows in heavy milk flow from twenty to thirty per cent of the blood sugar is removed. Unless a great deal of sugar is constantly flowing into the blood, the amount of sugar soon becomes low and then could not be taken out. It is important, therefore, that much blood sugar be available for high producing cows. Here again the pituitary comes into action. Just how the hormone works is not entirely clear but it has been proved that the amount of blood sugar is regulated in part by a pituitary hormone. This has been shown in two ways. 1. By removing the pituitary, the blood sugar is reduced to about one-half the former level; and 2. by injecting the pituitary hormone, blood sugar can be increased to more than double the normal level.

In a similar way, the pituitary has been shown to influence the fat, protein and mineral matter of the blood and thus indirectly the secretion of milk.

When any one of these hormones is deficient, milk secretion will be reduced a certain amount. Some cows might be much better producers if the inheritance of one gland could be improved. Work is now being started to provide methods by which the deficiencies which are limiting the production of individual cows may be learned. If it could be shown that the daughters of a certain sire were strong for a glandular deficiency in other cows, it might be possible by such a mating to greatly improve certain strains or families of cattle.

From the developments in the field of endocrinology as related to dairy cattle and milk production, it is probable that in the future more attention will be given to glands of internal secretion and the production of hormones than to external indications of production in the selection of cattle.

Fighting Fire Blight in Apple and Pear

Condensed from American Fruit Grower

Monroe McCown

Purdue University Agricultural Extension

MORE than 30 years ago the results of a test in Delaware showed that Bordeaux spray applied to blossoming pear trees reduced infection by fire blight. Later work in Illinois and Oregon gave similar results. Unfortunately, strong Bordeaux (6-12-100 or stronger mixtures) was used in these earlier tests and the pear fruits were russeted. Because of this injury to the fruits the tests were discontinued and the use of Bordeaux sprays during the blossoming period was discouraged. The results of more recent studies conducted in Indiana and other states show, however, that a weaker Bordeaux can reduce loss from fire blight without causing serious injury to the fruit.

Studies were initiated in Indiana by the writer in 1927 to determine (1) whether 2-6-100 Bordeaux (two pounds copper sulphate, six pounds hydrated lime, 100 gallons water) was sufficiently strong to prevent infection by fire blight in flowers of apple and pear, and (2) whether this strength of the mixture was weak enough to eliminate the danger of russeting of the fruit.

In laboratory tests, the fire blight bacteria were killed after short exposure to the Bordeaux. In orchard tests, the number of flower clusters that blighted, either as the result of natural spread of the organism or artificial inoculation with heavy suspensions of the bacteria, was reduced very materially by spraying with the weak Bordeaux. In commercial orchards located in different sections of Indiana the number of naturally infected flower clusters was reduced an average of 63 per cent in three tests with Jonathan apple, and 98 per cent in one test with Seckel pear. In six tests in which Grimes Golden apple flowers were inoculated with heavy suspensions of the bacteria in distilled water after the clusters had been sprayed with 2-6-100 Bordeaux, the number of clusters which became infected was reduced an average of 52 per cent as the result of the application of the spray.

During the course of these

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tests, mature fruits which developed from sprayed flowers were compared with those from unsprayed clusters. No serious russeting which could be attributed to the use of the spray was observed. The results of additional observations which were made from time to time in commercial orchards in Indiana support the earlier conclusion that russeting did not follow the use of 2-6-100 Bordeaux during the early part of the blossoming period.

Although the results of the tests reported above showed that fire blight infection was reduced by the use of weak Bordeaux, some growers hesitated to apply the spray fearing that the set of fruit might be reduced. While no reduction in fruit set had been observed in these tests, no comprehensive check had been made.

In 1935 and 1936, L. J. Doud, horticultural student at Purdue University, studied the effect upon set of fruit of the application of 2-6-100 Bordeaux to Grimes Golden apple flowers. All clusters were thinned to an equal number of flowers, only freshly opened flowers being left for the test. Each flower was thoroughly coated with spray. Under such severe treatment, which would not be duplicated in commercial orchard practice unless the trees were sprayed at intervals of one to two days throughout the blossoming period, the set of fruit was reduced an average of about one-fourth for the two seasons.

In 1937, the work was continued by the writer. Portions of Grimes Golden and McIntosh apple trees received one application of 2-6-100 Bordeaux when approximately one-half of the flowers were open. The individual trees were divided, one-half of each being covered with a tarpaulin while the other was sprayed thoroughly by means of a power machine (400 pounds pressure). The unsprayed half of each tree served as a check. There was no reduction in set and no russeting of the fruit. Similar results are reported from New York, following studies conducted during the past 10 years at Cornell University.

Additional studies in Indiana have demonstrated the need for spraying during the blossoming period for the purpose of controlling apple scab in some seasons. No serious russeting or reduction in set of fruit has occurred in Indiana as the result of spraying with weak Bordeaux during the period of blossoming. Owing to these facts, the application of 2-6-100 Bordeaux to susceptible varieties of apple and pear as the flowers are opening is suggested in the Indiana spray schedule.

The normal progress of the disease in an apple or pear cluster is described. Usually only one or

two flowers in a cluster become infected immediately following the introduction of the bacteria into the cluster. Following this initial infection of an individual flower, the bacteria progress down the pedicel or flower stem into the base of the cluster. From there, the bacteria progress upward through the pedicels of the other flowers, in this way involving the entire cluster. The importance of preventing the initial infection in a cluster, therefore, is obvious. Furthermore, prevention of the initial infection of the flowers eliminates an important means of increase of the inoculum and reduces, greatly, secondary spread to adjacent parts of the tree.

In the Indiana tests, and in most instances where commercial growers have used weak Bordeaux for blight prevention in this State, only one application has been made, usually when 40 to 50 per cent of the flowers were open. In the case of Grimes Golden, since the wood is quite resistant while the flowers are very susceptible to blight infection under Indiana conditions, only this one application seems necessary to provide adequate protection. There is evidence, however, indicating that two applications, (1) when 20 to 25 per cent of the flowers have opened, and (2) when 50 to 60 per cent are open, would be warranted in some seasons in the case of pear and apple varieties in which the wood, as well as the flowers, is very susceptible. Crop reduction and rather serious injury to trees resulted from fire blight infection in some orchards in Indiana in 1938. Under such conditions, one would expect to find a comparatively heavy source of infection present in these orchards in 1939. Weather conditions may or may not favor the development of the disease in 1939. If, however, rains and comparatively high temperatures (above 60 degrees) should occur during the blossoming period two sprays might be warranted in such orchards in 1939. No arsenate of lead should be included in sprays applied during the blossoming period, for this material is very poisonous to bees.

A number of Indiana apple growers have adopted the practice of regular use of 2-6-100 Bordeaux early in the blossoming period. If one may draw conclusions from statements made by other growers in letters, conversations, and at meetings following the serious outbreak of blight last season, many others will use the spray in 1939.

More Grass for Dairy Cattle

Condensed from The Ohio Farmer

C. L. Blackman

Extension Dairy Specialist, Ohio State University

EVIDENTLY, we are producing more grain than the market requires under present world conditions. Investigations also indicate that in many areas we are depleting our soil because we grow too many acres of depleting crops (grain) and not enough of the soil building (sod crops) grass and legumes.

If more land is devoted to grass and legume crops the question arises, "Can our livestock consume more pasture and roughage or will this change in the type of feed produced lead to an increase and possibly to an over-production of livestock, especially sheep and cattle?" It is safe to say that cattle and sheep could consume larger amounts of good quality pasture and roughage and less grain to advantage.

There is little question but that an increased consumption of high quality hay and pasture would lower the cost of milk production on many farms and contribute to the health of the cattle. While increased hay feeding has possibilities for good on many dairy farms, too much emphasis cannot be placed on the need of producing high quality hay and pasture. Feeding more hay of poor quality coupled with an attempt to feed less grain would only result in lowered production. Investigations prove that lowered production usually results in increased cost of production.

Just how far each farmer can go in increasing the hay and pasture consumption of his dairy cattle will depend in part on how much progress he has already made in producing feeds of good quality. In order to see how much change can be brought about in feeding practices, we will compare, as nearly as possible, the common feeding practices with those followed in high roughage feeding experiments by farmers who endeavor to feed large amounts of roughage and pasture.

Observation and studies indicate that the amounts of hay, pasture, silage and grain now fed to cattle vary greatly from farm to farm. Studies of dairy production costs on 17 farms in Greene County, Ohio, revealed striking differences in the amounts of the various feeds used.

In view of the fact that the

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average production per cow in Ohio is only about 4400 pounds of milk and 175 pounds of fat per year, it seems logical that we would get a better idea of the common feeding practices by comparing the feed consumed by the lower producing herds in each group studied. This comparison is shown in the following table:

Average amounts of feed consumed by herds studied in Greene County and herds in the low producing herds in Medina County, and in Dairy Herd Improvement Associations.

Source of Record	Greene County	Medina County	Dairy Herd Improvement Associations
Production Groups:	Lbs.	Lbs.	Lbs.
Average Milk Produced		5289	4048
Average Fat Produced	199	185	164
Feed Consumed:			
Silage	*6048	7237	5100
Hay	1025	2019	2500
Stover	8680	729	360
Grain	2170	2016	1660

*Average for two herds receiving silage.

Milk production is determined by both the inherited ability of the cattle to make milk and the methods of feeding. It is probably fair to assume that in most cases the lower production cows are also the least carefully fed. It seems reasonable to assume that this data gives a fair indication of the amounts of the various feeds, exclusive of pasture, commonly fed in Ohio.

Numerous experiments have been run to answer this question. However, the methods followed have varied and the location of the experiments and type of feed used have caused considerable difference in the results.

Fraser, of the University of Illinois, reports an experiment in which cows were fed all the corn silage and alfalfa they would eat over a period of six years. Except for a small amount of soiling crop and rye pasture, and less than a pound of corn (grain) per day, the entire feed of the cattle was derived from corn silage and alfalfa hay. All of the feed which the cows received was grown on the 20 acres where the experiment was run. Eleven good grade Holstein cows were used in this experiment. Nine of these were in the experiment all six years, and the other two remained in the herd nearly the entire time. The average production per cow for the entire period was 7470 pounds of milk and 262 pounds of butterfat. They consumed an average of 16 pounds of hay and 39 pounds of silage per head daily.

They remained in good health and vigorous condition during the experiment. All except the heaviest milker remained in good flesh, except during a few months of highest production. The highest producer was thin at freshening time one year.

Fraser observed that if grain had been available to add to the full feed of roughage when the cows were producing heavily, the production of milk per cow and per acre would have been greater. It is significant that the feed was of high quality and that this type of feed kept cows in good health.

Other experiments indicate that it is possible to feed larger amounts of hay and smaller amounts of silage than were fed in the Illinois experiment. Thus, it might be possible to get more of the roughage from alfalfa and other hay crops and less from grain (corn).

In order to keep production costs at minimum, it is necessary to keep cows producing to their normal capacity and to keep the costs of feed as low as consistent with high production. This brings up the question of the relative cost of digestible nutrients produced by grain and rotation hay crops.

At the Ohio Agricultural Experiment Station two five-year rotations were compared. One of these was chiefly a grain rotation and the other a "grass" rotation. The grass rotation produced 15,435 pounds of digestible nutrients as compared to 12,902 pounds of digestible nutrients for the grain rotation. Exact costs were not kept but the costs were definitely less for the grass rotation. So from the standpoint of costs, it appears wise to feed as much hay as practicable.

The fact that wild cattle thrive on pasture is good evidence that it contains all the nutrients necessary for life and reproduction. Recent investigations indicate that cattle can produce good flows of milk on good pasture alone, altho cows capable of high production require some grain during the period of heavier milk flow. At the National Agricultural Research Center, a Holstein consumed 150 pounds of pasture a day, which furnished enough nutrients to produce 45 pounds of 3.5 milk. This, of course, was good quality pasture. In Ohio, some of our dairymen, with improved (fertilized) pasture report that cows will eat little or no grain when in medium production. For example, in a herd of Guernseys, cows giving 25 or 30 pounds of milk, did not consume over three pounds of grain per cow, daily.

If permanent pastures are properly fertilized or good meadows are properly grazed, the amount of grain consumed annually may be materially re-

duced. Some investigations indicate that the nutrients in fertilized permanent pastures cost about one-half as much as those produced by rotation crops comparably fertilized.

The West Virginia Experiment Station compared treated with untreated pasture. Over a five-year period, the pasture receiving lime and a complete fertilizer produced more than double the amount of nutrients produced by the untreated pasture. The results were measured by the actual pasture days and the weight gained by the heifers on the pasture. Pastures receiving lime and phosphorus or lime, phosphorus, and potash produced much more feed than the untreated land, tho not as much as that receiving lime, phosphorus, potash, and nitrogen.

The value of pasture cannot be stated in the ordinary terms of digested nutrients. The vitamins and other factors contributing to the health of cattle can hardly be overstated. Investigations clearly show that the large amount of vitamin A in good pasture contributes much to the cow's health and capacity to reproduce as well as to the vitamin value of the butterfat she produces.

Since a cow has a limited capacity it is not possible to increase all feeds if she is already fed to capacity. It is possible, however, to reapportion the feeds and to make substitutions. If a large amount of hay is fed the silage must be reduced. If a cow is getting all the pasture she wants, she will not eat other roughages. A cow usually will take some grain even tho given all the hay and silage she will eat. As stated previously, cows in medium or low production may not take any grain while on good pasture.

In order to get optimum production it is necessary to feed some grain. The amount will depend on the stage of lactation, the way the cow responds, and also on the quality of the roughage consumed. Abundant feeding of good quality hay and pasture not only calls for less grain but also for less protein in the grain, which means a larger proportion of the grain may be produced at home.

The Trumbull County Experiment Farm has changed from a system of growing timothy and grain crops to one of growing alfalfa-timothy mixtures and grain crops. This has resulted in producing more hay and hay of higher quality and has revolutionized their system of feeding.

From 1929, when timothy was the principal hay crop, to 1936 during which time the hay was changed to alfalfa-timothy mixtures, the hay fed per day has been increased from 12½ to 26 pounds per day. This would mean

a change from 2500 pounds of hay to 5200 pounds of hay during a normal feeding season of 200 days. The grain has been reduced from 4232 pounds per cow per year to 2925 pounds. The production of cattle on test for the year 1936 was 11,700 pounds of milk and 403 pounds of butterfat, a little more than the production in 1929.

During the year 1936-37 the 34 Holstein cows on tests for the year in the herd of Bouic Brothers in Union County, produced 13,807 pounds of milk and 460 pounds of butterfat. The average consumption of feed was silage 4575 pounds, hay-alfalfa 4884 pounds, grain 3764 pounds.

The records of the two herds cited above and of others in Ohio show that good dairy cows can produce large amounts of milk efficiently when fed heavily on good hay and less liberally on silage and grain. If such cows can produce well on heavy roughage rations the average cow can produce to her normal capacity when fed relatively small amounts of grain and plenty of good roughage, especially hay.

Plan to Examine Chick Sexers

A plan to have those who are sexing chicks for breeders and hatcheries to pass an examination and meet definite requirements is offered the poultry industry by the International Baby Chick Assoc., Kansas City.

This plan calls for examinations in proficiency to be held under an official agency in each state where those who are going to do commercial sexing of baby chicks for breeders and hatcheries may stand the examination. Two hundred chicks must be divided as to sex in a time limit of twenty-five minutes. The applicants must have an accuracy of sex separation of at least 94 per cent.

Those who successfully pass this test will be issued a "Certificate of Proficiency" in chick sexing by the International Baby Chick Association.

Thus hatcheries will be assured that those who are doing sexing for them meet certain definite requirements. Raisers who are interested in buying either pullet chicks or cockerels will also have greater assurance of satisfaction of buying their chicks from hatcheries which employ sexers who have proved by examination that they are thoroughly competent to properly separate pullet and cockerel chicks on hatching day.—*Farm and Ranch*

Count Your Chicks Before They Hatch!

Condensed from The Poultry Item

T. C. Byerly

University of Maryland

INCUBATOR manufacturers and hatcherymen have made remarkable improvement in percent hatchability of eggs set and in quality of chicks produced during the past twenty-five years. However, the best incubator and the best hatcheryman can produce superior chicks only from superior eggs. The egg is a sealed package; deficiencies must be corrected before the egg is laid by proper breeding, nutrition and management practices. The hatcheryman can destroy hatching quality or he can preserve it. He can assist in its improvement by proper attention to the hatchery flock. Poultry science has led the way to many practices which may be followed to the mutual benefit of hatchery flock owner, hatcheryman and chick buyer.

Eggs of high hatchability are usually of excellent market quality. They are not jumbo eggs; they are not "vitamized" or "mineralized." their yolks are normally yellow in color. They are uniform in size, shape, shell color and shell quality. They have small, normally placed and firmly fixed air cells. No present measure of broken-out appearance may be accepted as a measure of hatchability nor is there satisfactory evidence that selection of breeders for high hatchability will improve the interior market quality of eggs from the progeny of birds thus selected. In general, any hen will produce eggs of higher hatchability during those portions of her life when she is laying eggs of standard market size, with sound shells, at a rapid rate, than during periods when she is laying irregularly or is producing very large or very small eggs or eggs with unsound shells.

The quality of hatching eggs is the biggest single factor in determining hatchery profits. It determines egg cost of chicks just as much as does the price of eggs. It also determines the selling price of chicks in so far as selling price is based on quality of chicks.

Egg cost per chick is the biggest factor in the cost of producing chicks. It is also the most difficult to calculate and to control.

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Hatchery profits depend on correct estimation of egg cost per chick and on control of that cost. Selling costs and incubation costs vary from hatchery to hatchery, but in general these factors are more readily controlled than egg cost. The price of electric current, the amount of current used, the cost of labor in the hatchery, may be calculated very closely before the hatching season opens. Initial cost of incubators and their depreciation are readily calculated. The hatcheryman must count his chicks before they hatch in order to calculate egg cost per chick!

Let's see what change in the proportion of chicks hatched to eggs set means to the hatcheryman and to the flock owner. Assume 60 cents per dozen as the price paid for hatching eggs in each case. Then egg cost per chick when 50 percent of eggs set hatch is 10 cents. When two-thirds of eggs set hatch, the egg cost per chick is 7½ cents. With an 80 percent hatch, egg cost per chick is only 6¼ cents. Obviously, the hatcheryman who sells 10 or 12 cent chicks cannot afford to pay 60 cents a dozen for eggs, only 50 percent of which hatch.

The accompanying diagram (page 31) is called a nomograph. This type of calculator was introduced to poultry students by Prof. L. E. Card, of the University of Illinois, several years ago. Egg cost per 100 chicks may be read by laying a ruler or stretching a string across the figure from the proper value for percentage hatch on the left to the proper value for price of eggs per dozen on the right and reading the value for egg cost per hundred chicks at the point where the ruler or string crosses the middle line.

Egg cost per chick is an important factor in determining the selling price of chicks, the premium paid for hatching eggs and finally, of course, profit or loss of the hatchery.

Counting your chicks before they are hatched is also necessary if two major selling problems of the hatchery business are to be solved. Conservative, well-managed hatcheries sell their chicks before the eggs are set. But suppose 100,000 chicks are sold, 150,000 eggs set to fill the order; this on the conservative assumption that 2 of every 3 eggs should hatch a salable chick. If 4 out of 5 eggs hatch, 120,000 chicks will be hatched—a surplus of 20,000 chicks. This looks like clear profit to the shortsighted hatcheryman, but if the condition is general, a surplus chick problem, with its inevitable price cutting, will surely follow. If only 1 out of 2 eggs set hatches, instead of the predicted 2 out of 3, only 75,000 chicks will be available to fill orders for 100,000. This most certainly means loss to the hatchery

even if customers are willing to wait for their chicks or consent to having their orders filled from some other hatchery. Over a period of years, a successful hatchery depends on satisfied customers who have confidence that they can obtain sturdy, profitable chicks from that hatchery when they want them.

Fortunately, the hatcherymen who can systematically predict the number of chicks they hatch can at the same time and by the same means assure their customers of chicks that will live and be profitable. The first step is to organize a close working arrangement between hatchery flock-owners who are sufficiently intelligent to adopt and follow the practices necessary to maintain a constant flow of hatchable eggs to an adequately equipped and efficiently operated hatchery.

Practices based on sound research and common sense, which will enable the hatcheryman to predict not only the number of chicks produced but their quality may be outlined briefly as follows:

1. General sanitation to control parasites. Heavily parasited birds are irregular producers. Their eggs are likely to show poor hatchability.

2. Pullorum elimination. Chicks from flocks from which reactors have been removed suffer less mortality than chicks from untested flocks, unless the chicks themselves are exposed to the disease in the incubator or during the first few days of brooding. The hatcheryman must accept the fact, for the present, that if his customer exposes chicks, free from pullorum, to that disease, that such chicks may show excessive mortality from pullorum. Breeding for resistance to the disease seems possible but is still in its infancy.

3. Avoid flocks which are currently suffering heavy mortality from range paralysis.

4. Segregate eggs from flocks which have passed through a period of years of heavy losses from range paralysis from eggs from flocks which have never had range paralysis. Sell chicks from paralysis-free flocks to customers whose premises are free from the disease. Sell chicks from flocks which have passed through the disease to customers on whose premises the disease occurs.

1. Set only clean, not cleaned, eggs.

2. Neither incubate nor hatch eggs from pullorum tested flocks in the same incubator nor even in the same room with eggs from untested flocks.

3. Keep the incubators and premises physically clean—with hot water, soap, and a good, stiff scrub brush.

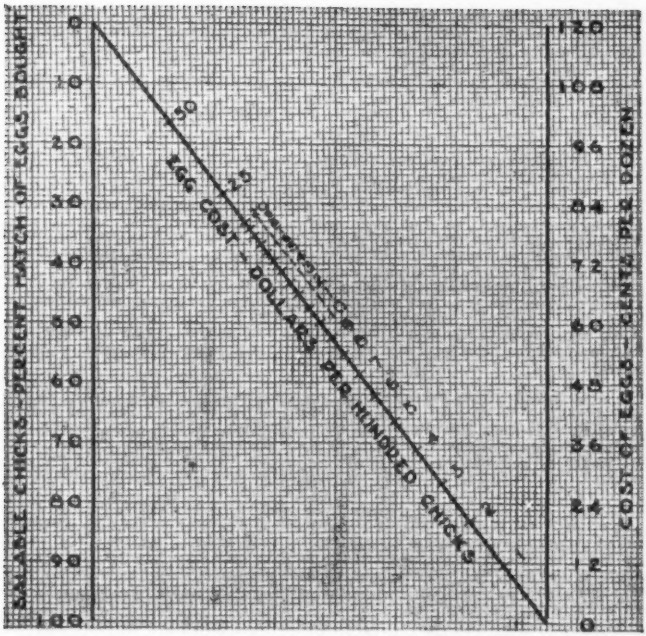

Figure 1. Relation between Hatchability, Egg Cost of Chicks, and price paid for eggs.

BREEDING PRACTICES

For the mass-mated flock

1. Cull for body size; this helps to maintain egg size; eggs which weigh 24 ozs. to the dozen hatch better than 20 oz. or 30 oz. eggs. Small eggs hatch small chicks; jumbo eggs hatch late, heavy chicks. These very heavy, late-hatched chicks often suffer excessive mortality during the first 3 days of brooding.

2. Cull for reasonable adherence to breed standard.

3. Owners of mass-mated flocks of 200 or more breeders may safely use cockerels from their own flocks. Smaller flocks must be supplied with unrelated cockerels in order to avoid decreased hatchability due to inbreeding.

For the pen-mated flock

1. Selection for high hatchability by means of progeny testing is an assured method of maintaining or improving hatchability. There is a very large number of inherited factors which decrease hatchability. The progeny test is a practical means of controlling them.

Nutrition and Management

1. Most manufacturers of commercial feeds honestly try to supply adequate breeding rations. Such rations, if complete, are not cheap. Insist that flock owners buy good mash unless you are assured that their intelligence and information is equal to compounding a satisfactory mash of their own.

2. Access to growing green grass, clean soil and direct sunlight will not cause a decrease in hatchability in any flock. If the flock is receiving a poor diet, direct sunlight and access to a good green range will bring hatchability up to normal within a few days.

3. Keep the breeding flock comfortable and in high production. Hens which lay on several successive days hold the fertilized yolk in their bodies about 24-26 hours. Hens which lay on alternate days are likely to hold the fertilized yolk for 28-30 hours. This is 2-4 hours too long at the body temperature of 105-107° F.

4. Mashes for confined breeding flocks must contain or be supplemented with 1 to 2 percent of cod liver oil or its equivalent in vitamin potency. Cod liver oil is not a complete supplement for sunlight so see that birds get all the sunshine they can be given practically.

5. Make sure that the mash given confined breeders, carries adequate quantities of milk products—5 to 10 percent, or its proven equivalent in substitutes.

6. Manganese is essential and cheap. Four ounces of manganese sulfate per ton of mash is enough.

7. If your flock-owners pay a premium for their feed in order

to obtain a service program as well as a good feed, see that they get what they pay for.

Care of Hatching Eggs

1. See that eggs are gathered several time daily, cooled quickly to 50-60° F. and held there prior to incubation.

2. Transport eggs carefully, rough transportation causes tremulous air cells, and eggs so affected suffer in hatchability.

3. Set only sound eggs weighing between 23 and 26 ozs. per dozen.

Incubation Practices

1. Follow the instructions of the incubator manufacturer.

2. Check the mechanical condition of the incubator. Warped cabinets open cracks—cracks make drafts—drafts cause uneven temperature in the incubator. Some eggs may develop too slowly, others too fast. Uneven hatches are often poor hatches of unthrifty chicks.

Inaccurate thermometers may rob you. One degree above normal incubation temperature is dangerous—more dangerous than one degree below normal. Chicks incubated at high temperature are small, with poorly erupted down.

Turn eggs at least 3 times daily, at equal intervals; 5 equally spaced turnings are better.

Check humidity; eggs should lose about ½ percent of their orginal weight each of the first 18 days of the incubation period —100 standard weight eggs should lose 18 to 20 ounces during this period. Wet bulb thermometers may register inaccurately if air flow in the incubator is inadequate or the wick choked with down.

3. Handle incubating eggs gently; a jar insufficient to crack the shell may kill the developing chick during the period from 4-14 days incubation. Injury is less likely during the third week of incubation.

Fertility

1. See that every hatchery flock is supplied with vigorous, well matured males at the beginning of the season.

2. Test a sample of eggs from each flock prior to using the eggs from that flock for hatching. If fertility is low try to improve it by better care of the cockerels or replacement.

3. Salvaging infertile eggs through identification after 14-18 hours incubation is possible but marketing such eggs is often unsatisfactory.

Bryn Mawr's Medal Sire Cost $52.50

Condensed from The Jersey Bulletin

A YOUNG "Torono" bull who nearly "went west" by way of the butcher's block, who was saved by science, and who lived five extra years to beget a bevy of 21 extra daughters, three of which recently qualified him through their high records for the American Jersey Cattle Club Silver Medal—that's the inside story of Sophie's Emily Torono 237791.

Used, during his earlier service periods, to run with the herd, this "Torono" bull proved to be a slow breeder at South Dakota State College of Agriculture. And, so, he was in the discard in May, 1932, when Mr. Frank B. Astroth, Bryn Mawr Farm, St. Paul, Minn., saw him in something less than top condition. Mr. Astroth looked not so much at the overweight bull (although a small bull, "Torono" tipped the scales at 1,500 pounds) but rather at his distinguished ancestry.

"You can have him," said Prof. T. M. Olson, head of the South Dakota Dairy Department, "at beef price."

Mr. Astroth accepted the challenge. "Torono" was granted a reprieve for exactly $52.50. A month later, he rolled into South St. Paul quite ingloriously—with a carload of steers. At Bryn Mawr Farm he was put into training to reduce his corpulance and to give him a new lease on life.

"We proceeded to starve that belly off of him, and to exercise him regularly," Mr. Astroth recalls. "By fall, he began to show just a little interest. Then, a friend told me about the hormone treatment that had been developed in California. This hormone is obtained from a serum from pregnant mares. It is of little benefit unless the animal to be treated is fertile because, although it increases the animal's desire if properly administered, it does not change the spermatagenesis. We checked up, found 'Torono' was fertile, and Prof. William Regan, of the California Dairy Department, supplied the hormone extract. Dr. Boyd, of the Minnesota Experiment Station, gave 'Torono' three injections at 10-day intervals. He was soon breeding like a two-year-old."

Useful to the last, "Torono" died just a year ago, the recent medal having been awarded posthumously. During the five years after commutation of his death

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sentence, he sired a long string. Eleven of his 21 Bryn Mawr Farm daughters are in milk and, according to the owner, all but one will make medal requirements. The other 10 are due to freshen within the year. A number of his sons have been sold.

If the records of the three medal daughters that qualified Sophie's Emily's Torono for his Silver Medal are any indication of what their sisters will do, Bryn Mawr Farm can look forward with pleasurable anticipation to their accomplishments.

The first daughter, Owl Oxford Emily won Gold and Silver Medals with a record of 661.09 lbs. butterfat, 12, 665 lbs. milk in 305 days. She was started on this test at 2 years and 9 months of age.

Torono Emily Rose, the second daughter to win the Silver Medal, was 2 years and 2 months of age when started on her test and yielded 438.04 lbs. butterfat, 8,483 lbs. milk in 305 days.

Sugar Corn

SUGAR corn contains approximately twice as much sugar, twelve times as much dextrin but only half as much starch as Dent corn. Only one pollen grain is necessary to produce one fertilized grain of corn. However, it is estimated that 50,000 pollen grains are produced for every fertilized grain.

Sweet corn which is harvested and properly cured in the dough stage will germinate very well.

Open pollinated corn: Fertilized by pollen from its own tassel.

Top cross sweet corn: The male parent is inbred—the female parent is open pollinated.

Inbred hybrid sweet corn: Both the male and female parents are inbred. When crossed, a hybrid results.

Golden Cross Bantam is the result of crossing Purdue 39 with Purdue 51 which are inbred strains. Purdue 39 is the female plant which has a large ear but which is poor in quality. Purdue 51 is the male parent with a scrawny appearance but which has an ear with much sweetness and creamy quality. The result of this cross is a large ear which is very high in quality. Do not save seed from this cross as it will not come true to type. Buy your seed each year from one who makes a business of producing it.

A long thick husk repels the corn ear worm which is also a cannibal.

—*J. A. A.*

Ton of Pork, Twice a Year

Condensed from Breeder's Gazette

IS Paul Fisher, 38-year-old farmer of Carmel, Ind., the Ton Litter King of the U. S.?

1st yr.—Paul Fisher takes 10 sows, raises 10.9 pigs per litter, and in 180 days feeds out all 10 litters over the ton mark to an average weight per litter of 2,074 lbs.!

2nd yr.—Paul Fisher, with the same sows, averages 9.9 pigs per litter raised, and in 180 days again grows out each litter to above the ton mark; average weight per litter, 2,152 lbs.!

That's the highest production record ever attained for 10 sows in Purdue's popular pork producing project. Does not this amazing record set a new high for the U. S.?

Paul Fisher is essentially a good farmer, first; a great hogman, second. Record breaking is merely part of his attempt to do a good job of his farming. He heard about 5-acre corn club work in 1934. More corn per acre, more profit per bushel. He joined up. Since 1934, he has, on three occasions, been the outstanding corn producer in his county. In his first attempt, he produced 90 bushels of corn per acre on a 5-acre plot. Two years he averaged 112 bushels. Last year he boosted the yield to 134 bushels per acre. He buys little fertilizer; depends mostly on conserving and rebuilding his soil with legumes and the manure produced by his small dairy herd of 7 Jersey milk cows. His neighbors told me that when he took over the 80, his place was just an average farm of good Hamilton County land. One rich 15-acre plot on his farm had been built up to do 90 bushels of corn per acre, when he took over. On the same plot last year he produced 130 bushels per acre.

Fisher still operates the original 80 acres, but he rents another 120 acres to raise enough feed for his stock.

Long before he had ever heard of ton litters, Paul Fisher was vitally interested in feeding hogs for the more profitable gains. In 1933 he first ventured into purebreds and bought four Hampshire sows. He spent a year or two getting the type of the stock he wanted. In 1935, he attended a county livestock meeting and heard about the E. J. Barker Trophy offered for herd production results, and resolved, then and there, to make a try for it. With improved type hogs and using the newer methods of feeding and disease prevention control,

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he had unofficially produced a ton litter or two. He had heard about crossbreeding purebreds for market pigs. He bred his 10 purebred Hampshire sows to a purebred Poland-China boar. Result: 125 February pigs. Mrs. Fisher caught the spirit behind the contest and helped with the tiny sucklings. By weaning time they had 109 pigs left out of the 125 born, and these they raised and finished. That year was one of the hottest and driest summers on record. There were days when heat and dust forced him to move them to the shade of the big barn. They had to watch every detail, to be able to finish 10 litters averaging 2,074 lbs. per litter at 6 mos. Last year they bred the same 10 sows, finished out their 99 pigs in 180 days, with an officially recorded weight average of 2,152 per litter, and won the Barker Trophy for the second year in succession. So far as I can discover, Fisher last year set the all-time U. S. peak record volume in pork production. What makes the record even more striking is the fact that all of these sows were used to produce fall litters in addition to producing record-breaking springtime litters. Here is the record of the 10 sows for the two years: Spring litter, 1936, 109 head, 25,095 lbs.; Fall litter, 1936, 100 head, 21,448 lbs.; Spring litter, 1937, 99 head, 24,545 lbs.; Fall litter, 1937, 69 head (from 9 sows, because one sow failed to breed), 14,410 lbs. A total of 85,498 lbs. for the two years.

How does he do it? First, he chooses his boars and sows with great care. He says that he hasn't learned how to judge breeding stock by looks and is forced to judge an animal almost entirely by the size and kind of litters produced. Nevertheless, he has mental pictures of what he considers his ideal gilt and sow. He is careful to see that the animals are not too rangy, with deep chests, good backs, full hams, strong bone and a good line of nipples. His ideal matron weighs around 400 pounds. He is strong for Hampshires, Durocs, and crosses between these two breeds. He carefully follows all the practices recommended in the McLean County method of pig raising, uses completely clean individual hog houses, carefully washes sows before pigs are farrowed; moves houses, sows and pigs onto clean ground without ever allowing any chance of worm infestation. Pigs are castrated at 4 weeks; the litters are vaccinated at about 8 weeks.

Since boyhood he has been a strong advocate of pasture for porkers. He starts pigs on wheat pasture, later switches them to red clover pasture. Fully 20 of the total 80 acres each year are in red clover for pasture alone.

The dairy cows and all of the sows and pigs are carried on these 20 acres. "It's more profitable to pasture legumes than to cut them and store them for hay," says Mr. Fisher. Rations are farm mixed. Grains go through a small grinder. Small pigs are fed a ration of ground corn, ground wheat and tankage until they weigh about 60 pounds. After that they get shelled corn and tankage until threshing time. Then wheat is substituted for corn. Fisher believes that hogs finish better on wheat than on corn; that the change makes their rations more appetizing. He says that it is hard to shift the feeders back on to corn, however, and that it is best to continue feeding wheat until the hogs are marketed. All hogs have access to clover pasture. The milk is sold whole. A small milking machine saves wear and tear.

Last year this progressive young farmer did not compete for the big Barker Trophy now residing on his desk. He was just content with rebuilding his team of sows for—well, we may be reporting on that, this summer, 1939.—*L. J. B.*

Group Buying of Farm Machinery

COMMUNITIES in Carroll County, Arkansas, have been successful in pooling money and buying machinery cooperatively. For several years these farmers grew small grain but had no machinery for handling it.

The Douglas community led off several years ago, and other units in the county and adjoining counties have since adopted the same plan. A machine service is organized and incorporated. Seeders are purchased with fertilizer attachments, a tractor-binder, a 30-H.P. tractor, a thresher, a hammer mill, and disc plows. In one community unit the corporation paid out $600 for labor, $250 for operating costs, added $245 to equipment, paid $75 for repairs, and still applied $664 on the indebtedness in 1937.

At the end of the first season, some years ago, the first unit organized threshed 25,000 bushels of grain, plowed 350 acres, and cut 350 acres.—*R. J. Hubbard, Nebraska Farmer*

Fertility Problems in the Production of Vegetables

Condensed from New Jersey Farm and Garden

V. A. Tiedjens

IF I were to summarize the important problems of the vegetable grower, that deal with production, I would list the following items in the order of their importance:

1. Insufficient liming materials.
2. Insufficient fertilizer.
3. The absence of rotations which include cover crops.
4. Methods in fertilization practices.

It seems strange that we should have to talk about lime. We have talked lime for years and yet lime is our greatest need. We do not seem to appreciate the fact that we must use lime just as we do fertilizer. The idea of dumping on lime once every four or five years may be sufficient for field crops, but it does not meet the need of the intensive vegetable grower.

Many of our farms have become so low in lime that the value of the land has actually depreciated. If one were going to buy a farm and found out that it needed five to ten tons of liming material per acre to bring the soil back to a high state of fertility, one probably would not pay much for it. The buyer would have to figure on an additional investment, because with present prices he should not charge the cost of the lime to one season's crop. He must think of it as depreciation. To get best results it is necessary to bring the soil back to its high level of fertility and then maintain it by small applications of lime every year. Sandy soils play out in much less time than heavy soils. Also, it takes less lime to bring a sandy soil back to its potential level of fertility. This can be done in less time on light soils than on heavy soils.

What do we mean by lime requirement of soils?

Soils have varying amounts of finely divided clay and organic matter which makes a jelly-like film throughout the soil. This film combines with calcium and magnesium from the lime and potash, sodium and ammonia from the fertilizer, to form a source of plant food material. As plants

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grow, these nutrients are again gradually released. Unless the soil can perform in that manner it may not be productive. If this jelly-like film has all the lime it can hold and very little sodium or potassium, the soil is crumbly when dry and drains very easily. Such a soil is in a high state of fertility and will grow good crops with mixed fertilizer. If, on the other hand, the jelly-like material has no lime in it, but is saturated with sodium and potassium, drainage becomes bad, the soil crusts over, bakes hard when it is dry and may become very slippery when it is wet. Such a soil is better suited for holding stones in place in a wall than it is for growing crops. Furthermore, when a soil once gets in this condition, it requires very drastic treatment to correct it. Calcium is easily leached out, but is very slowly replenished uniformly by applications of liming materials.

There is an idea that if nitrate of soda is used it is not necessary to use lime, because the pH does not change; furthermore, that if you use sulphate of ammonia you have to use lime to keep the soil from becoming too acid. But we do not want a sweet soil resulting from soda. We want to keep it sweet with lime. A high pH due to lime means a fertile soil. A high pH due to soda means a poor soil. Therefore, we should use lime with nitrate of soda, as we do with ammonium fertilization. There is much less danger of the soil becoming saturated with soda if we use lime with it. We must use enough lime to supply the calcium needs of plants as well as to counteract injurious properties of other nutrients. In this respect the function of calcium cannot be substituted.

What can be done about a soil that has a high pH but is low in liming material? There are lighter soil areas in New Jersey where this condition exists. Where there is an accumulation of sodium as a result of using nitrate of soda liberally and no liming material, we can use magnesium lime as a correction. However, gypsum or land plaster may correct such a soil more rapidly, because it has both calcium and sulphur and both have a beneficial effect in causing the sodium to leach. That is one reason why sulphate of ammonia and lime applied every year will give good results. The combination of the two when applied forms gypsum in the soil. Thus we need liming materials to build the calcium content as well as to correct acidity.

Lime does not penetrate the soil quickly. Therefore, if it is intended to correct an acid condition in a short time, liming material should be plowed under as well as broadcast on the surface. It may require years to correct an acid subsoil if only small amounts

of lime are applied on the surface. For this reason a soil when once properly saturated with lime should have small amounts of lime put on every year to prevent the accumulation of acidity.

Not until we have our soils in good condition from the standpoint of lime can we expect the most efficient use of fertilizer.

A subsoil that is poorly limed discourages deep rooting, with the result that we have to supply plants freely with plant food at the surface. This does not promote uniform growth. Soluble salts move up and down in the soil and unless roots are well distributed through the subsoil and surface soil the feeding area of the plant is very much restricted. Water may become a critical factor under those conditions and plants will suffer in dry weather.

Much fertilizer may be wasted on poorly limed soils. However, there are many cases where the fertilizer needed for ten acres is spread over twenty. Growers should concentrate their efforts rather than spread out thinly. It is wiser to make a profit of $10 an acre on ten acres than to lose $25 an acre on twenty acres.

If the soil is in bad condition because of lack of lime the loss may be even greater.

Crops requiring acid soils may give better results with a high phosphorus fertilizer, because phosphates become unavailable after a short time on acid soils. Such soils when limed may slowly release this phosphorus again.

A small amount of potash goes a long way on acid soils, while on well limed soils potash is needed in more liberal quantities. More than seven per cent potash probably will not show any response on acid soils. However, if there is an abundance of lime in the soil some crops will require much more potash. Our fertilizer problem is to get enough fertilizer in an available form and this again depends on lime. If our soils are acid, if is far more important to spend part of our money for lime than to spend it all for fertilizer and none for lime.

Green manure crops in rotations will increase the quality of our produce as well as yields. Growing deep- and shallow-rooted crops alternately with a cover crop that may be plowed under every three or four years has a beneficial effect that tends to improve the soil by accumulating plant food in the surface. Deep-rooted crops tend to bring plant food to the surface for shallow-rooted crops. However, this is not a corrective measure and will not give best results until the subsoil and surface soil will support good root growth. Here again we come back to satisfying the lime needs of the soil. We must look at crop production as a system of growing crops rather

than supplying fertilizer or lime or something else. Lime, manure, fertilizer, cover crops, method of applying and quantity of fertilizers are all an integral part in producing good yields.

Methods of fertilization have considerable bearing on our problem in certain years. Fertilizers should be applied in such a manner that they are available to the plants in amounts that will give a sturdy growth that isn't too succulent.

Fertilizer applied partly broadcast and partly as side dressings has usually given good results. Where all the fertilizer is placed in the row under the plants, uneven conditions are set up. Plants want their plant food in smaller doses. A little fertilizer under the plants and the remainder as a side dressing at several intervals throughout the growing season will give good results. The band method is particularly suited for poor soils where phosphorus will tie up rapidly when applied broadcast. However, even with this method some side dressing in addition to the bands of fertilizer is necessary to obtain best results. Plowing under part of the fertilizer ahead of the crop has some possibilities for deep-rooted crops.

There are many practices of this nature which will produce results on some farms and not on others, and growers should try them out in comparison with their own methods. They can learn more about their soils in that way than any other method that they might use to find out what is wrong with their soil. But after all is said and done, New Jersey growers will have fewer production problems if they will satisfy the calcium requirement of their soils. Fertilizer is like fire—a little helps, too much burns, the correct amount satisfies our needs. Lime makes it possible for us to obtain the most out of our plant food.

Wound Protectants for Citrus Trees

Condensed from Texas Farming and Citriculture

W. H. Friend

Texas Experiment Station, Hidalgo County

THE importance of using sanitary precautions and adequate wound protection in tree surgery is becoming increasingly evident in the citrus orchards of Lower Valley Grande. For many years Texas growers have been inclined to treat all manner of wood diseases of citrus trees with contempt or indifference. Following disasters of major proportions such as damaging cold weather and winds of hurricane force, it has been the policy of many growers to allow the resulting wounds to go untreated and unprotected for many weeks, or even months. Under semi-tropical conditions, such neglect is quite likely to result in wound infection of serious magnitude that may eventually lead to the early deterioration of the affected tree.

Likewise, the neglect of pruning wounds or the use of wound protectants of questionable value, may result in facultative wood rotting, parasitic fungi gaining access to the inner tissues of the trees. Thousands of Valley trees have been seriously, if not irreparably, damaged by the use of so-called "pruning compounds" that were either lacking in antiseptic value or lacked the properties necessary for the maintenance of a weather-proof coating that would not "blister" or crack under the stresses and strains such wounds are subject to. In addition to furnishing protection from diseases and the "elements," the ideal wound protectant must also protect against the depredations of a wood inhabiting species of fungus-feeding ant that tunnels into the inadequately protected wood of tree wounds. By packing their tunnels with moist plant material, these ants materially aid in the spread of facultative wood parasites.

During the early days of the Texas citrus industry, the most generally used wound protectants were lead-zinc paints and pine tar. Of these two, pine tar was the most satisfactory, and this material, with certain reservations, must still be considered a reliable protectant.

Prior to the 1930 freeze, a wound dressing had been devel-

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oped by the Valley Station for use on citrus nursery stock and on smaller pruning wounds. Following the freeze, considerable quantities of this preparation were used in treating bark splits caused by the low temperatures. This mixture was composed of equal parts by weight of a commercial grade of pine rosin and a 1 to 1000 alcoholic solution of mercuric chloride. This material is highly satisfactory as a "first coater" for tree wounds but tends to shrink the tissues and cause "checking" of the protectant, resinous covering. While searching for a relatively pure asphaltic cement that might be applied over the rosin-alcohol coating, we conceived the idea of mixing pure gilsonite asphaltum with a thinner that would impart antiseptic and ant repellant properties to the mixture. This naturally lead to the consideration of phytonomic (plant-safe) carbolineums. One of the old established brands (Avenarius) was tried and appears to be well adapted for the purpose. It is realized that carbolineums vary to a marked degree in their chemical composition and that the material is primarily a wood preservative. It is hoped that some manufacturers will become interested in the production of a standardized product that is designed for use on horticultural plants. Low phenol content appears to be associated with the plant safety factor, but other constituents of ordinary grades of carbolineum may cause injury to plants. Likewise, commercial grades of roofing asphalt vary in composition and usually contain sufficient tarry materials to cause excessive callus development that may have a cancerous appearance. Plant tumors have been caused by the use of roofing cements containing appreciable quantities of coal tar.

Asphalt-emulsions that may be thinned with water have been extensively used in the Valley, and many trees have become severely infected with heart rot because of the inadequacy of this material as a wound protectant on citrus trees. The material has no antiseptic value and may even serve as a medium for the growth of certain fungi. When used as a wound protectant, it should be applied only as a second coat on tissue that has been previously sterilized with plant-safe carbolineum, the alcohol-mercuric chloride-rosin mixture, or some similar preparation. Thousands of disease infected and ant-infested wounds of citrus trees are now hidden by asphalt-emulsion coverings that appear normal to the casual observer. Dark-colored wound protectants are not entirely satisfactory where the wound is fully exposed to the sun's rays.

While in quest of a cheap and effective light-reflecting wound

dressing, a cheap white enamel was compounded that appears to be highly satisfactory for use during the dormant season when sap pressure is at low ebb. During the summer season, there appears to be no way to avoid the two-coat method of wound protection, if blistering and gumming are to be entirely prevented. The use of the petroleum resin varnish (Rust-ban) as a vehicle for various combinations of zinc oxide with mercuric chloride, mercuric oxide, phenol salicylate resorcinol and other antiseptics was immediately suggested, and fairly extensive orchard trials of these materials have been made. Results secured with the various materials have been summarized and certain conclusions appear to be justified.

Nine-year-old grapefruit trees growing under comparable conditions were used in testing all of the materials. The size of the wounds used in these studies ranged from one and one-quarter to three inches in diameter. All saw and shear wounds were smoothed off with a chisel or knife before the protectants were applied. Small paint brushes were used in applying the wound dressings, and no special care was exercised to prevent the material from covering the bark surrounding the wounds. One series of treatments was applied during the winter season (February) when the trees were relatively dormant. Another series was applied during the spring season (March) when there was a strong flow of sap accompanying the spring flush of growth. The last series was applied during the early fall season, when there was also a strong flow of sap, following summer rains.

Conclusions

1. A large percentage of improperly protected tree wounds become infected with pathogenic fungi which seriously affect the health of citrus trees, causing gummosis.

2. All pruning wounds should be made flush with the trunk or parent limb and should be smoothed off with a knife or chisel. Even short stubs (1/16 inch long) retard healing to a marked degree.

3. The ideal wound protectant should have the following characteristics:

(a) Low surface tension, so as to insure thorough soaking of the live, green tissues with the antiseptic.

(b) It must be a non-injurious antiseptic.

(c) It should be ant and termite repellant.

(d) It must be pliable and weather-proof to prevent cracking that might result in wound infection.

(e) Other factors being equal, light colored dressings are pre-

ferred for use on exposed wounds.

4. Sap pressure appears to have a considerable effect on the adhesiveness of wound protectants.

(a) Apply a priming coat of low surface tension to wounds made during the growing season. (Alcohol - rosin - bichloride or plant-safe carbolineum).

(b) Apply second coat of asphaltum-carbolineum or petroleum varnish-zinc oxide enamel with mercuric oxide not less than sixty days after priming coat was applied.

5. Tarry fractions of some roofing cements cause abnormal callous development of cancerous appearance.

6. Pure asphaltum of relatively low melting point when mixed (hot) with equal parts (boiling) plant-safe carbolineum is a cheap, safe, and effective black wound protectant for use on citrus trees.

7. A mixture composed of 50% petroleum varnish, 48% zinc oxide, and 2% mercuric oxide is a more expensive but very effective white wound protectant for use on citrus trees, especially on wounds exposed to sun rays.

8. All tree wounds should be inspected at least twice each year, in order that infections may be checked before serious damage has been done, as infectious gummosis may gain access to the trunk and cause early decline of the affected tree.

New Vaccine for Horses

A new vaccine has been recently introduced which will make it possible for farmers to give their horses full-season protection against sleeping sickness. This new vaccine is prepared by inoculating the partly developed chick bodies of incubated eggs with the sleeping sickness virus and it is many times more effective than the type of vaccine formerly used. One vaccination in hay should be sufficient for the entire season.

Water in the Ground Is Cash in the Bank

Condensed from Farm and Ranch

TWELVE years records on the Spur Experiment Station show an actual increase of $91.25 per acre in cash returns for cotton through holding all the rainfall on the field, as compared with unterraced land alongside with the same slight slope of 6 inches in 100 feet. Averaged over the entire period, the cash benefits amount to $7.60 per acre per year; but the crop was hailed out or otherwise lost three years (which had nothing to do with the water conservation), so the true average for the nine crop years is $10.12 per acre per year over the unterraced land.

"There was a good deal of good-natured chaffing when someone proposed closing the ends of level terraces back in 1926," says R. E. Dickson, Spur station superintendent. The suggestion came up in a conference of agricultural workers held to plan further research in soil and water conservation. Level terraces had already shown an advantage over terraces with the customary "fall" and most people thought land with no more than a slope of 6 inches to the 100 feet (half of 1 per cent) did not need terracing at all.

Closed end level terraces 18 inches high with a vertical spacing of 12 inches were constructed on one plat and the companion plat left as Nature made it. During the twelve years for which records have been made a total of 229.77 inches of rain have fallen, of which 26.59 inches ran off the unterraced plat; or 11.57 per cent of the total. In four years the run-off was less than an inch, which might appear hardly enough to effect the result. Three to 4 inches got away each year from 1935 to 1938 inclusive, while the other years show a loss of 1.5 inches to 2.88 inches.

All the water that fell on the closed-terrace plat of course went into the ground, which is classified as Abilene clay loam. If you think .38 of an inch of rainfall running away is too little to bother about, note that in 1927 the plat which lost no water made 40 pounds more lint cotton than the one from which a mere fraction of an inch ran off.

Again in 1933, with a total rainfall of 15.59 inches for the year, only .90 of an inch ran off the unterraced plat; but the yield was 116 pounds per acre higher on the terraced plat. Fall rains stored on the terraced plat had a

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bearing on that year's crop, since the other plat lost nearly 3 inches of the rainfall of 1932, or 10.22 per cent of the total.

The greatest difference in yield for any one year occurred in 1928, when the unterraced plat lost 14.41 per cent of the rains and turned out only 58 pounds of lint cotton per acre, while the yield from the terraced plat was 217 pounds—a difference of 159 pounds, worth on that year's market (including both lint and seed) $26.44.

In 1935 there was a difference of 152 pounds between the two plats, worth at the current market, $16.99. That was a year of comparatively high rainfall for the region, with 23.78 inches; but more than 3 inches ran off (12.87 per cent) from the unterraced land, which yielded 118 pounds of lint against 270 pounds where all the water was held on the field.

Not a single year in which a crop has been harvested but has shown an advantage in favor of the closed-end level terraces. In all but two years a single crop would have repaid the cost of terracing several times over.

The Spur experiments started as "soil conservation" research, but the results have shown that "water conservation" is even more important under certain conditions than merely holding the soil.

Chop Roughage for Lambs

Condensed from The Farmer

Richard Davids

SHALL we chop our roughage for use in livestock rations? This is a question which has entered the foreground for discussion by farmers and feeders. Its answer in relation to feeding lambs has been answered in part by experiments conducted at the Minnesota West Central School and Station at Morris.

A second problem of importance studied was the possibility of self-feeding lambs a mixture of ground grain and hay. Ordinarily it is almost impossible to feed lambs hay and self-feed the grain because of the danger that many will overeat and die. To prevent deaths from overeating, grain has been diluted or mixed with bran. The Morris experiments considered the mixing of chopped hay with the grain.

Eight lots of feeding lambs, 30 to a group, were picked for use in the study. For three weeks prior to the opening of the trial they were fed wild hay with a little oats and oilmeal. Their average weight at the beginning ran around 64 pounds.

"The first group was handfed, twice a day, whole alfalfa hay and coarsely ground shelled corn with 10 percent linseed meal. Exactly the same amount of hay and grain was fed the second lot except that the hay was chopped. After 77 days of test the first group showed an average daily gain of .335 pounds against .384 pounds for the second. There was an average feed cost per hundred pounds of $5.61 for the whole hay group against $5.15 for the chopped hay group. In spite of the extra cost of grinding hay, the second lot brought a return over costs of $1.65 in contrast to $1.41 for the first." The second lot brought a return of 12 cents more per bushel of corn used, or $.84.

Lots 3, 4, 5, and 6 were self-fed varying amounts of ground alfalfa hay and cracked corn with 10% oilmeal. Lot 3 was fed 60% chopped hay and 40% corn. Lot 4 got 50% each of hay and corn. Lot 5 got 40% hay and 60% corn, and lot 6 was fed a mixture of only 30% hay and 70% corn.

At the end of the trial, the lambs in lot 3, after having self-fed for 77 days the ground hay-cracked corn mixture of 60% hay and 40% corn, weighed an average of 89 pounds. They made

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a daily gain of .32 pounds, with a feed cost of $6.08. They brought a margin of $1.27 over feed costs.

Lot 4, fed half and half by weight of ground hay and corn, made average daily gains of .37 pound, with a feed cost of $5.64 per hundred pounds of gain. They brought a margin of $1.48 over feed costs, which was 21 cents more than the margin made on the lot fed the leaner mixture.

Lot 5, self-fed 40% hay and 60% cracked corn and oilmeal, averaged .416 pound daily gain with a feed cost of $5.26 for every hundred pounds of gain. This lot brought a margin of $1.67 over feed costs.

Lot 6, fed the ration of 30% hay and 70% corn, made a daily gain of .44 pound—a tenth of a pound more per day than the hand-fed group getting whole hay. This group brought a margin of $1.71 over feed costs, and paid 80 cents a bushel for the corn they used.

Self-feeding the lambs occasioned no more trouble with death losses than in the hand-fed groups. Four lambs died in the self-fed and four lambs died in the hand-fed groups. The lambs fed the heaviest grain rations took three weeks to reach full feed.

The final lots, 7 and 8, were run to determine the advisability of feeding oilmeal in the ration. From the experiment, as in previous ones, it was concluded that with the use of high quality alfalfa hay, a high protein supplement will usually prove unprofitable. With fair to medium hay used, such a supplement will be profitable, will result in more rapid gains and better finish.

A regular power-driven grinder with three-quarter inch screen was used. Such grinding was computed to cost around $2 a ton. Grinding and self-feeding in a mixture reduced the amount of labor necessary. The lambs seemed to like best the finest ground hay.

In general, the experiments show that there is an increased daily gain per lamb as the proportion of grain in the mixture increases. This equals pretty closely the margin per lamb over feed cost. The best proportion seems to be the 40% hay- 60% grain ration since there is possibly less danger in feeding, and the gains are about as high as the heavier grain mix.

The studies with feeding lambs were carried on under the direction of P. S. Jordan, of the Morris station, in co-operation with W. H. Peters, of University Farm.

Community Forests

Condensed from Southern Agriculturist

J. E. Stanford

DURING the next few years we probably shall hear a good deal about the subject of community forests.

Community forests consist of properties owned and operated for forestry purposes by a community, town, city, district, county or other political subdivision, or by other community or group enterprises such as schools, hospitals or organizations. These forests may be used for many purposes such as the growing of revenue producing timber; recreation through hunting, fishing, boating, swimming and picnicking; sanitation and other protection of community water supplies; means of employment; wildlife sanctuaries; demonstrations of adapted timber; production of raw materials for local industries; putting idle, unattractive and abandoned lands to productive uses, and the establishment of rural club houses and work centers.

Well managed and productive forests may yield from $1 to $4 per acre per year from the sale of timber products such as pulpwood, fuel wood, Christmas trees, poles, piling, sawlogs, etc., as well as other products that may be available. In Europe yields of from $3 to $12 per acre per year frequently occur and some yields as high as $12 to $20 net per acre per annum have been noted.

There are more than 2,000 community forests already established in the United States. New York has 579 and has planted 68,000,000 trees on them. New England has several hundred. Georgia, Michigan, and Wisconsin have started many school forests, partly as reforestation projects. Wisconsin has an excellent and exemplary program of county forests, with 1,746,647 acres in 25 different counties. These county forests vary in size from about 5,000 acres to more than 200,000 acres. In Mississippi a program is on foot to convert many school lands into a series of county and local community forests. In Indiana, North Carolina, New Jersey, Pennsylvania, Washington, Tennessee, and in many other states considerable progress has been made.

European community forests furnish a valuable guide and pattern for us to follow. There are many thousands of community forests in Europe. Some have

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been established for hundreds of years. Many yield handsome profits which pay part or all of the village or city taxes. Some communities are completely tax free because of the profits from these forests. About 66 per cent of all the Swiss forests, and a large part of the famous Black Forest in Germany, are in community forests. And they combine profit and pleasure. Park and forest objectives are fulfilled and both purposes are happily and successfully served. They are the most successful, popular and profitable type of forest ownership in many districts of Europe.

Usually community forests are secured by acquiring tax-delinquent lands, by purchase and by gift of land, or funds with which to purchase land. They have their beginning usually through some public spirited person or group desiring to make the community a finer, happier, better and more prosperous place in which to live for both present and future generations. Extension foresters, county leaders, luncheon clubs, mayors, scout organizations, legion posts, women's clubs and sportsmen's clubs have been most effective in promoting the forest projects already under way.

There is no conventional rule to follow. One solid block is more easily administered and protected as a community forest, but this is not necessary. Nor is there any conventional rule to follow when organizing and promoting these forests. The reasons for establishment, the opportunities available, and the nature and conduct of these forests will vary with local circumstances and conditions, and particularly with the attitude and interest of local groups of citizens.

These forests generally should start from small and modest beginnings. They will expand in size and importance with the years and as local circumstances permit. Some already established have started as 10-acre tracts and developed into forests of several hundred acres.

Such properties are generally tax free. On the other hand, they should be so conducted that they will ultimately help in relieving the citizens of taxes for schools, roads, fire and police protection, etc.

Questions as to where, how and what trees are to be used in a community forest can best be answered by the State Forester or other competent forestry official. This advice is free, and assistance will be gladly given. Needless to say, trees suitable to local climatic and soil conditions and those likely to bring the best prices when ready for local markets are the ones that should be used.

National and state forests will not serve as community forests, as generally these forests are located

much too far from our communities. There are some 170 million acres of national forests and about 17 million acres of state forests. About 30 per cent of all our forests in the nation are in public ownership, but less than one per cent are in community forests. We need more nearby woods which are close to markets for the timber products and which also supply quick and low-cost outlets for recreation.

In most states, laws permit the acquisition and operation of these forests by counties, town, villages, cities, etc. A letter addressed to your State Forester at the State Capital or State College of Agriculture will bring a copy of the law or the conditions under which these forests may be established, if such provisions have been made in your state.

Lose Much Soil Nitrogen

Condensed from Michigan Farmer

FARM soils in the United States each year lose nearly 23 million tons of nitrogen through harvested crops, grazing, erosion, and leaching, according to the USDA 1938 Yearbook of Agriculture. Only a little more than 16 million tons are given back to the soil in the form of fertilizers, manures, rainfall, irrigation waters and legume crops.

Soils of this country have from 2,000 to 16,000 pounds of nitrogen per acre down to a depth of 40 inches—in areas studied by scientists. It is estimated that the air above an acre of soil, however, contains from 145,000 to 150,000 tons of free nitrogen, although it must follow what is known as the nitrogen cycle before becoming available to plants and animals.

There are two ways by which free nitrogen of the air may be "fixed" in the soil. One is natural and the other artificial. Lightning discharges unite nitrogen and oxygen to form oxides of nitrogen. These unite with moisture in the air to form nitrous and nitric acids which enter the soil with rain. By other natural processes bacteria free in the soil and in the roots of leguminous plants also transform air-nitrogen into fixed nitrogen.

In artificial fixation man does what lightning and soil bacteria do—he brings free nitrogen into combination with other elements. Man's success is shown by the fact that in 1900 two-thirds of the world's nitrogen supply was obtained from nitrate deposits in Chile. 34 years later 74 per cent of the supply was obtained from the air and fixed in the form of chemical fertilizers.

Emergency Repairs for Farm Buildings

Condensed from The Nebraska Farmer

Ivan D. Wood

Extension Agricultural Engineer, Nebraska State College of Agriculture

WHEN a barn or other major farm building collapses in a windstorm, there is often little salvage value and the owner is likely to suffer considerable loss unless he has been farsighted enough to carry insurance. It is possible, of course, to save some of the lumber but the labor of removing nails and sawing off the broken and cracked sections of plank is costly. Often the heavier frame material is so twisted and splintered as to be of little value for use again. The representative of a large company, operating many farms in this state, told me recently that their experience in salvaging wrecked farm buildings had been discouraging and that they would often have been money ahead to have given someone the lumber for clearing it away.

For some years money to spend for new buildings or for the repair of old ones has not been plentiful. As a consequence, each heavy windstorm takes its toll. It is interesting to note, however, that those structures which were well built in the first place have stood up through the years and are yet available for a long period of service. It is the poorly built crib, granary, shed or barn which is about to give up the ghost or has done so already.

Foundation failure is one of the most common causes of trouble. I recently photographed a combination corncrib and granary which had been built, at considerable expense, a few years ago on a farm in northeastern Nebraska. When I saw it, a repair crew was jacking up the sills and replacing splintered studding and joists because someone neglected to get the foundation walls down into the ground. Apparently the heavy structure had been set on concrete walls, the bases of which extended less than eight inches below the surface. The water from the roof, assisted by the constant rooting of hogs, had removed the dirt from around the footings and a wreck was the result.

Concrete walls eight inches thick with a spread of 16 inches at the base, carried from two to two and one-half feet below the

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ground surface, will safely support heavy barns, cribs and granaries in most cases. It always pays to keep hogs away from building foundations, particularly on side-hill locations. A great deal of damage also results from water dripping from the eaves and this can best be prevented by spending from $15 to $25 per building for eaves troughs and downspouting which will pay good dividends in the long run.

Many otherwise well constructed farm buildings were set on loose stone foundations which have long since settled, fallen apart or been partially removed. The only logical cure is to raise the structure with heavy timbers and jacks, replace the crumbling stone with a good plumb concrete wall and lower the sills to their new resting place. In some cases, the dirt has been partially washed away from concrete foundations which were not carried down deep enough or made broad enough at the base. If the walls have not settled too badly, it may be possible to dig under them at intervals and run in a deeper and broader base. In some cases, the old foundation walls can be replaced and held in position by running in new footings even where sections have overturned. Often retaining walls can be used to hold the earth in position close to the footings and on side-hill locations the drainage water should be diverted by means of ditches or proper grading. One thing is sure, well-constructed foundations would have saved thousands of farm buildings which today are either wrecked or in a bad state of repair.

Few farm buildings are properly braced to stand severe storms. The side pressure in a heavy wind may run into thousands of pounds which rocks the structure back and forth so that in time nails are broken off, timbers are split and deformed and eventually a wreck occurs. Experiments have shown that the old type of wind bracing formed by nailing short pieces of frame material between the studding is not very effective. In new construction, a better method consists in letting 1 x 4-inch or 1 x 6-inch rough boards into the studding on the outside next to the siding. These boards run from the upper corner of the building near the eaves diagonally down each side wall to the foundation.

In applying corner braces to old buildings, it is not necessary to remove the siding since the rough boards can be nailed to the studding on the inside in the same diagonal direction indicated for new constructon. Large expanses of roof should be braced diagonally by securely nailing rough 1 x 6-inch fence boards to

the rafters. This diagonal bracing of side walls and roof will work wonders in holding a structure steady in severe windstorms.

Aside from wind bracing, certain other strains must be taken care of by the use of correctly placed timbers. Not long ago I inspected a barn which had a sway-backed roof. The rafters had pushed out the side walls, spreading the building at the eaves to such an extent that it was about to fall down. Had some good 2 x 10-inch timbers been used to tie the studding at the plate back to the floor joists, this building would be in good repair today. The ends of large barns often blow inward due to poor bracing and when this happens the roof is almost sure to go. It is neither difficult nor very expensive to carry braces from the sides of the hay door down to the floor joists. Often the braces on the rafters of self-supporting barn roofs are poorly designed or poorly nailed or both.

In many old barns, corncribs and granaries, the joists are not heavy enough to carry the loads to which they have been subjected and as a result are badly bent out of shape or broken. Posts which are supposed to support girders have been knocked out of place by livestock or wagons, allowing floors to settle and roofs to sag.

Most all farm buildings of any size need a certain amount of interior cross bracing to keep them from being pushed out of plumb. To understand how essential this is, it is only necessary to take the cover of an ordinary match box and push sideways on the top and note how easily it can be deflected out of shape. If two matches are broken to the right length and set diagonally, from corner to corner, we have cross-bracing and the box cover is very rigid. This principle seems to have been poorly understood when carpenters built the structures on many farms. With proper foundations and some additional cross and corner bracing, thousands of dollars worth of repair and actual loss could have been prevented.

Often a few dollars spent for emergency bracing and foundation repair will save a building from collapsing until a more permanent job can be done. About the only equipment necessary to put a structure back in its original position is several heavy jack screws and a few heavy timbers or old telephone poles. If the side walls are leaning badly, the jacks can be set inside against the sill and the timber used to push the upper part of the opposite wall back into position. When the walls are plumb, cross and corner bracing may be applied. By means of the jacks and poles of different length, stringers can be

lifted and posts replaced, bulged side walls can be shoved back into place and, in fact, almost any case of deformity can be handled.

It is true that foundation repair and emergency bracing are the most essential things which can be done at present in the case of many farm structures. But, on the other hand, many roofs need reshingling to prevent decay of rafter and interior framing. In many cases, the siding needs renailing and barn doors need immediate repair before they are a total loss.

Deferred System with Rotation Pasture

Condensed from Capper's Farmer

M. N. Beeler

FOR fifteen years Jens G. Thuesen's production program has not varied. It involves a cropping system that is as inflexible as weather will permit, and a livestock enterprise that is as stable as home grown feed supplies will justify. No changes in crop market prices affect his rotation. No ups and downs in the meat and feed trade influence his purchases of calves and lambs.

He plants the same acreages of corn, oats and clover mix each spring. Unless weather ruins seedings he plows down the same acreage of meadow each year, always has the same acreage of hay to put up, the same size rotation pasture to graze; an unvarying area of stubble, aftermath and stalk fields to utilize in the fall. Barring hazards of drouth, insects and storm that may ruin corn, he makes a specific tonnage of silage each year.

The only leeway which his system permits is a fluctuation in number of feeders. That is because seasons affect feed production. Normal calf purchases are 100 head annually, 75 in fall and 25 in spring, but occasionally half each time.

Minimum number of lambs is 300. But when moisture is plentiful and growing conditions otherwise favorable, when fall grazing is in sight, he may increase purchases to 400. Such a season is likely to produce surpluses of steer feed and so he may buy 25 extra calves, but usually not until spring.

Crop land on his Grundy county, Iowa, farm is divided into 10 25-acre fields. Two of these may

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be seeded to an alfalfa-clover-timothy mixture, 4, 3 and 5 pounds of seed respectively to the acre, every spring with oats as a nurse crop, or the acreage may be divided between alfalfa and clover and timothy. If a seeding fails to catch any year, then the next opportunity extra acreage is sown. As a result of drouth in 1934 and 1936 he sowed 75 acres in 1935 and 60 in 1937.

Each year he plows two fields of old stand, plants them and two fields plowed the year before to corn, a total of 100 acres. Normally there are two fields in one-year-old mixture and two in two-year stand, so that even tho a spring seeding may fail, there always are 100 acres of hay and pasture and a portion may be left to stand over.

Thus his system requires, barring seeding failures which occur infrequently, that 40 per cent of the land be in established stands of hay and pasture, 20 in new seeding and oats, or a total of 60 protected, and 40 per cent in corn. Only twice, therefore, in a 5-year rotation is the surface exposed to erosion and during that time, because of the organic matter which has accumulated thru years of manuring and plowing down vegetable matter, there is not much danger of soil loss.

Corn, the only exhaustive crop in his system, is definitely limited in acreage, estimated to meet his minimum requirements. In fact corn production is not the measure by which he gauges feeding operations. Rather it is roughage and pasture.

"I chose the rotation and cropping system as a soil building and maintenance measure," Mr. Thuesen explained, "and adapted my livestock program to it. My intention is to produce as much meat as possible on the least corn. Other feed determines my lamb and calf purchases. If I have roughage, I do not hesitate to buy corn to balance the ration.

"But my feeding system is designed to make the greatest possible use of mixed pasture and hay. Those are my most important crops, the ones to which the greatest acreage is devoted."

The major feature of his beef making plan is not unlike that developed by Dr. C. W. McCampbell, of Kansas State College. It involves the same practice of deferred feeding, but whereas the Campbell system is designed to afford the maximum utilization of native grass, Mr. Thuesen is applying the same idea to afford a market for rotation pasturage.

He buys 300 to 400 pound good quality calves for October-November delivery. They are carried thru the winter on limited rations designed to make them develop rapidly and gain some—a practice which Doctor Mc-

Campbell described as "wintering well." They get all the silage and alfalfa or mixed hay they will eat, ½ pound of cottonseed meal and 4 to 6 pounds of grain daily.

When pasture is ready, May 1 to 10, the ration is discontinued and they subsist entirely on grass at least 60 days and sometimes longer. He is prepared to grain the calves lightly beginning in July. The allowance depends upon condition of pastures and upon trend of the cattle market.

Grazing may continue well into August, but normally Mr. Thuesen expects to begin dry lot feeding about the first of the month. At that time, tail enders are removed from the herd and returned to pasture. The tops receive all the grain they will take, legume hay and cottonseed meal, during 100 to 120 days. That puts them on the market about a year or a little over from the time they were brought to the place. They will have gained 650 to 700 pounds during that time and will finish at 1,000 to 1,100 to sell at baby beef prices.

"I always try to have some ensilage left over for feeding in July and August," Mr. Thuesen remarked. "With that I can make them eat at the bunk in hot weather when they won't graze. The tail enders run on fall grass and in stalk fields until they are cleaned up or until bad weather sets in. Along in February I begin feeding them and they finish in late spring or early summer.

"I avoid heavy feeding or finishing cattle in two periods of the year—mid-summer and mid-winter. The best gains are obtainable, in my experience, from September to December or early January and from February thru June."

He feeds only enough hogs to follow the cattle. Any in excess of that would require producing more corn which would throw his cropping program out of balance.

"To get my seedings, and to provide bedding I raise oats. To utilize the grain I feed lambs because they can handle it to better advantage than any other class of stock. They also provide additional outlet for roughage and grass without increasing my corn requirements.

"My feeding program is so arranged as to utilize feed that becomes available in summer, some of which cannot be stored for winter. In fall there always is a surplus of aftermath, crop residue and other forage which can not be mechanically harvested profitably. That's where lambs are helpful."

They are delivered between August 1 and September 1. Upon arrival they are lotted, for a 48 hour rest during which they are given a fill of dry feed, clover and

timothy hay. After that they are turned to bluegrass or stubble pasture an hour or two the first day. Back in the lot for the night they have hay at will. The second day they are returned to pasture after the dew has dried for a little longer period.

After the third or fourth day, I begin feeding whole oats, only a bushel for all of them at first," he explained. "The allowance is gradually increased as they learn to eat. During the last two or three years I have been allowing them a limited grazing of alfalfa by driving them across it to clover and timothy beyond. After they have had a fill of the mixture, they will work back across the alfalfa of their own accord.

"Sometimes there is good grazing for lambs in cornfields during early fall. In those years, I turn mine in after four or five weeks. To keep them from eating corn, I have, heretofore, sown rape at the last cultivation. Seeding is easily accomplished by mounting three 3-gallon cans, on a two-row cultivator, one over each of the two outside and one over the two middle gangs. Holes in the bottoms let the seed out and a curved piece of tin properly located under each affords even broadcasting. The size of hole regulates the rate of seeding. I prefer a pound an acre.

"Lambs like the rape and will pay little attention to corn, except to nibble blades, when it is available. Recently I tried an experiment in providing rape pasture which, if it works out, will obviate sowing it in corn. I added a sprinkling of it to the mixture seeded with oats so it would afford additional grazing in the stubble fields and also protect the new seeding."

Each night the lambs are brought up and corralled to insure that they get their oats allowance. After frost kills vegetation they remain in dry lot until finished. He expects them to gain about 10 pounds a head a month and to be ready for market between November 15 and December 15. They usually average 95 pounds delivered in Chicago.

Virginia State Game Farm

Condensed from The Southern Planter

THE great diversity of Virginia agriculture affords abundant and varied food for all kinds of wildlife. Thousands of acres of rough, submarginal land provide ample cover for game. And the State's early entry into the rearing of game in captivity for restocking purposes, has contributed mightily in maintaining Virginia as a sportsman's paradise.

About 25 miles southeast of Richmond on the Williamsburg road, a roadside marker reads as follows: "State Game Farm—established, 1920, for breeding partridges in captivity on a large scale. The first institution of the kind in the world. Game sanctuaries are stocked from this plant."

This farm was purchased in 1919 at the direction, and under the personal supervision, of Governor Westmoreland Davis, president and publisher of *The Southern Planter*. The land, buildings and equipment cost approximately $35,000, and were paid for out of the Game Protection Fund—receipts from hunting, fishing and trapping licenses. The Davis administration adopted the policy that it is the duty of a state to lead the way in wildlife restoration to offset the depletion wrought by licensed sportsmen. By wise selection of game officials, and through economy and efficiency of administration, Governor Davis gave Virginia a constructive, forward-looking game program that has had far-flung influence on wildlife conservation, and he retired from office with a balance of $100,000 to the credit of the Game Protection Fund.

The State Game Farm lies along the Chickahominy River, near Windsor Shades, in New Kent county, and contains about 1,400 acres. In addition to the rearing operations on quail and wild turkeys, it is said to be the greatest wildlife sanctuary in Virginia. It is alive with wild turkeys and deer. Deer seem to understand the protection afforded by the State Game Farm, because when hunting dogs run them on nearby farms, they invariably head for the game farm. No hunting, with dog or gun, is allowed on the farm at any time.

The breeding work of the farm is under the direction of J. C. Wall. He reared 3,000 Bob White quail last year, several hundred wild turkeys, and a quantity of the newly introduced Chukar partridge. The Bob Whites are mated in early spring—a male and female in egg cage—and egg-laying starts around May 1. Eggs

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are collected once a week and placed in incubators or under Bantam hens. The birds continue to lay up into September. Bob White hens will average 80 eggs per season in captivity—three times their normal production under natural field conditions. Good birds frequently lay in excess of 100 eggs per year at the game farm.

Two separate and distinct methods of rearing are in use: (1) artificial incubation, brooding and rearing; and (2) natural methods, using the Bantam hen to hatch, brood and look after the young quail.

"From our experience," Mr. Wall said, "We would advocate the Bantam hen every time for the beginner or the small operator. A Bantam hen can be set on 20 to 25 eggs, she eliminates the mechanical pitfalls inherent in any small brooding equipment, and the cash investment is negligible. Also the hen will teach the newly hatched birds to eat without the slightest difficulty, and that is a big problem with artificial incubation. For the highly skilled breeder, and for the large plants, artificial methods are advocated. Modern methods have done for quail raisers exactly what they have accomplished for commercial poultry producer."

Quail eggs hatch in 23 days, and the hen with little birds is transferred to specially designed brooder boxes on the second day after hatching. These coops are 20 inches wide and 5 feet long, with a small compartment at one end to hold the hen. The bottom is covered with course sand. The sand is changed once a week to prevent the accumulation of filth which might breed disease. A special quail mash is kept before the little fellows in clean hoppers, and they grow by leaps and bounds. If weather is good, they are moved to pens, 30 feet by 60 feet, provided with shelter, grass cover and all the mash and clabber they will take. At 5 weeks of age they are taken from the hen and placed in large wire coops. These are moved every 5 days to new soil until the birds are shipped when 10 weeks old.

For artificial brooding the State Game Farm uses both electricity and oil. The same type of brooder box is used as for the Bantam, but instead of a hen, the heat is supplied under a small hover with a Putman oil heater, or electricity. "The oil heater is very simple and inexpensive, and I would recommend it highly for the farmer breeder," Mr. Wall said. The oil heater holds a quart of kerosene and will burn for 15 days, supplying enough heat for 30 birds. In artificial brooding, heat must be supplied for 5 weeks when the birds go into the range coops, along with those reared by hens. The feeding is identical.

At 10 weeks of age the birds are ready for shipment. In the early days of the farm, all quail went to game sanctuaries, but now they are distributed to privately owned farms, where needed for restocking purposes, throughout Virginia by the State game wardens. Land owners who obtain birds from the State must agree to feed them in severe weather and protect them from hunters and dogs for at least one year. Usually 10 birds—5 males and as many females—are shipped in a single box, and liberated on each farm.

The practical demonstration which was given Virginia and the Nation under the administration of Governor Davis through the establishment of a model State farm, is a lesson in conservation that should be heeded by game lovers everywhere. Man cannot continue to destroy game cover with fire and axe; allow dogs and cats to catch young game; eradicate whole covies of quail with dog and gun; and expect to enjoy good gunning year after year. If people are to protect their hunting heritage, they must save breeding stock, protect young game and systematically restock depleted areas.

Grass and Clover Seed Cost Money

Condensed from American Agriculturist

EVERY year a staggering sum of money spent for alfalfa, clover, and grass seed is wasted. Either the seed fails to catch for one reason or another, or the clover or alfalfa is killed out during the winter. One of the biggest reasons for failure with alfalfa or clover is unadapted seed. For example, in 1936-37 farmers in states where clover seed is grown sowed over 400 carloads of clover seed from Europe. Seed with foreign ancestry grown last year is no longer foreign. We might say it has become naturalized, and it might even carry a U. S. verification tag showing the state in which it is grown. That seed may be American, but that doesn't necessarily mean that it is adapted for the Northeast. In fact, the assumption is that it isn't. It is important to be sure that domestic seed is grown in a state where the climate is at least as severe as it is in the Northeast.

In most years a lot of foreign seed is imported, some of which is good and some is bad. The Federal Seed Staining Act provides that a small percentage of all imported alfalfa and clover

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seed be stained. Violet stain indicates that it comes from Canada and that it is hardy. Green stain indicates caution, and shows that either alfalfa or clover seed comes from countries with relatively mild climates. Any seed, part of which is stained red, should be definitely out as it means danger.

Seed grown in this country does not need to be stained, but not all of it is hardy. It is safe to buy certified Grimm alfalfa from a reliable seed house; and hardy common alfalfa grown in the Dakotas, Montana, and possibly Idaho and Utah, may be used in sections where conditions are favorable.

Most states have seed laws which supplement the Federal Seed Staining Act and which require that seed sold or exposed for sale be labeled with a tag showing per cent of germination, date the test was made, and percentage of weed seeds and inert matter. The tag gives the facts, but does not prohibit the sale of poor seeds. Any man who buys seed without studying that tag is taking a chance.

State laws are not effective in controlling poor quality mail order seeds. For example, M. T. Munn, New York State Seed Analyst, tells of an analysis of alfalfa seed from a western state advertised at $15.60 a bushel. It looked like a bargain, but tests at Geneva showed that each bushel contained only 23 lbs. of good seed, and on that basis cost 69c a lb., where the very best hardy alfalfa seed with a high germination test could be purchased for 45c per lb. In addition to that, the analysis showed several kinds of weed seeds, some of which are considered as noxious weeds in most northeastern states. It wasn't such a bargain after all. One of the surest ways of getting good seeds is to deal with a concern that you know is reliable.

One way to cut the cost of grass seed when it is high and scarce is to seed less per acre. If all conditions are made favorable so that a big percentage of the seed actually grows, an excellent stand can be secured by using half the ordinary amount of seed. By good conditions we mean a properly prepared seed bed, inoculation, and an adequate supply of lime and phosphorus. In some years the nurse crop used has an important bearing on the grass crop. A little lighter rate of seeding nurse crops than is normally used helps, and getting the nurse crop off early gives the grass and clover a better supply of moisture. In one sense, peas make a good nurse crop because they come off relatively early. Cutting oats for hay instead of grain also leaves the grass in entire possession of the ground early in the season.

You may think that because

alfalfa or clover has previously grown on the field you are seeding, it is unnecessary to inoculate. You may be right, but the chances are that inoculation will pay. It is not costly either in money or time, and a good many states now have laws which require that commercial inoculants be tested before being offered for sale. Most firms that sell inoculants put out products that are entirely reliable. It is wise to be sure that the inoculant you buy is not too old. You will usually find on the package the date beyond which it should not be used.

Alfalfa needs a deep, well-drained soil, and it is a waste of money to put it on ground that has the water table close to the surface. Alfalfa grows best in soils naturally supplied with lime. Lime can be added to soils otherwise favorable, but it is difficult —in fact impossible—to get lime well mixed into the subsoil, and alfalfa roots grow deep.

It is good insurance to have your County Agent make a lime requirement test. If the result shows the requirements to be less than a ton of ground limestone per acre, it can be added shortly before seeding. If the land needs more lime to grow good alfalfa, it is better to put it on several months in advance.

Red clover needs lime too, although it is not quite as particular as alfalfa.

Clover and alfalfa need phosphorus. A sort of blanket recommendation when seeding alfalfa is 500 lbs. of 16 per cent superphosphate or its equivalent per acre.

In seeding alfalfa, a good many farmers prefer to work the land occasionally during the spring to kill weeds, and then to sow the alfalfa without a nurse crop some time between June 15 and July 15. Then, if weeds get too much of a start, they can be clipped with a mowing machine. Others seed with a nurse crop of oats or barley, but seed lightly, some not using over a bushel of oats or barley per acre.

The spring of 1940 will see the usual number of new seedings where the catch of clover or alfalfa is so poor that it is necessary to plow up and re-seed, but the man who uses good hardy seed, prepares a good seed bed, inoculates, and supplies adequate amounts of lime and phosphorus is likely to find his barns full of hay a year from next summer.

Specialty Farming Depends on Markets

Condensed from Better Crops With Plant Food

E. N. Bressman

U. S. Department of Agriculture, Washington, D. C.

THE possibilities in the field of specialty crops might on first consideration appear almost limitless since there are some 250 different common drug plants alone that might be grown. Actually, however, the possibilities are limited by the small and indefinite market that exists for most of these plants. Most specialty crops have been exploited or propagandized at one time or another, and it cannot be too strongly emphasized that prospective growers should not become too enthusiastic about the possibilities of rare or little-known ones.

There is, however, no desire to discourage prospective growers in cases where there are real possibilities of successful production, an assured market, and fair returns. In the specialty field, a grower need not limit himself to plants used exclusively in drugs, for there are many related plants that have uses in the manufacture of drying oils, insecticides, and related fields. In recent years possibly the greatest interest has been in plants yielding drying oils and insecticides, such as soy beans, safflower, pyrethrum, and nicotine tobacco.

There are several established growers of crops of relatively minor importance, such as spearmint, peppermint, wormseed, ginseng and golden seal. The possibilities for new growers in the production of these crops, however, are definitely limited.

At present many of the plant products that go into drugs are imported. Chemists and industrialists interested in producing every possible agricultural product in this country, noting these products on import lists, have time and again set them up as having real agricultural possibilities. A few years ago a drug manufacturer stated that under certain conditions there were 50 different drug plants that could be grown in this country. There was little evidence, however, that any of the plants he had in mind could be profitably grown in this country.

There are a number of miscellaneous crops of sufficient value to warrant an investigation of

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their possibilities in the United States. Two comparatively new crops that might find a place in the drying oil industry are perilla, adapted in the South and Southeast, and chia, apparently somewhat adapted in the Southwest. Likewise, there are two crops that have shown some possibilities in tannin production. They are canaigre, in New Mexico and Texas, and sumac in the South. For perfume oil, roses, lavender, and clary sage in the Pacific Northwest and West, and rose geranium in Florida and southern California have been under consideration. There are a number of species of Ephedra that are being investigated for alkaloid content. The adaptation of this crop to areas of low moisture and soil makes it of particular interest. One of the newer plants thought to have value as an insecticide is commonly known as Cracca and devil's shoestrings. This leguminous plant, which grows wild throughout the East and South, has in some localities been found to contain a fairly good yield of rotenone in its roots.

It is extremely important that any prospective grower of botanical crude drug plants, such as digitalis, belladonna, and aconite, should get in touch with one of the various large wholesale drug concerns dealing in these products before embarking on their production. Many concerns have very strict requirements as to the kind and quality of materials that they use, also as to packing and handling. Because of the variation in these products, no standard package or bale is available for all drugs. It must be remembered that in some cases the whole plant is desired, whereas in others, it is the leaves, stems, or rootstocks that are wanted. Some plant products are purchased solely on the basis of their drug content and others on the basis of their appearance. Naturally, it would be desirable to pay only for the actual drug content of a plant, but in many cases this is difficult to determine. In the case of pyrethrum, purchases were formerly made entirely on the basis of appearance but there is now a great tendency to make purchases on the basis of the pyrethrin (poisonous principle) content.

Prices of drug plant products fluctuate violently. Overnight they might be reduced 50 per cent or increased to 300 per cent. This is sufficient reason for any grower to require some sort of specific agreement or contract for his crop. Certain drug plants require more than one year to come into production, and in the case of many perennials, it is not profitable to grow them unless the crop can be harvested for several years after it is establish-

ed. No one would wish to establish a permanent crop on a price basis that might change overnight. In other words, the production of this sort of plant is risky unless an assured market is established before any kind of production is undertaken.

Many roots, herbs, barks, and leaves are gathered from the wild by farmers. There are various centers for this sort of collecting. In the southern Appalachian Mountains, in the vicinity of Asheville, North Carolina, and in southwest Virginia there are important centers for collecting, and several of the large wholesale drug houses have warehouses in these places for the purchase and storage of certain products. In the mild coast area of the Pacific Northwest, many drugs are collected from indigenous plants, including the world's supply of cascara bark, an important cathartic drug. Another area for wild plant collection might be found in the New England States.

In Miscellaneous Publication No. 77 of the United States Department of Agriculture there are described 128 different American medicinal plants of commercial importance. These range all the way from aletris, a grass-like herb, the rootstock of which is used in drugs, to yerba santa, a tarweed, the leaves of which are used in the drug trade. Some of those listed are used only in limited quantities, but others are in fairly constant demand. Among the latter group may be mentioned black cherry, bloodroot, boneset, burdock, cascara, catnip, ginseng, goldenseal, jimson weed, mayapple, pokeberry, sassafras, snakeroot, tansy, and wormseed.

It is well to remember that every crop has an optimum environmental condition. No one condition is satisfactory for all plants. There is great variation in requirements of heat, moisture, shade, and soil conditions. Many plants will not stand the warm, humid conditions found during the growing season in some parts of the South. On the other hand, plants of the non-hardy type will not survive winters of low temperature. As a whole, specialty crops are not attacked to any great extent by diseases or insects, although each has some sort of enemy—a leafspot, fungus, borer, leaf-eater, rodent, or other pest. Still, growers of specialty crops run all the risks of growers of staple crops, and in addition have far more specific requirements to meet as regards the quality of the crop produced.

In general, a grower of specialty crops must be a specialist. Although training in chemistry is not essential, it is desirable, since it helps the grower to appreciate proper handling of his plants, particularly after harvesting, in

order that the greatest amount of valuable principle may be retained. In many ways the specialty crop grower is like the seed grower. He must produce a quality product if it is to find a ready and profitable market. Wheat, corn, and cotton even of inferior quality usually find a market of some sort, but there is no assured market for specialty crops of just any old kind, poorly harvested and cured. In many cases specialty crops of poor quality find no market and are a total loss.

Side Placement of Fertilizer Pays Dividends

Condensed from The Furrow

Donald L. Robertson

COMMERCIAL fertilizers cost farmers money, and when money is spent to grow better crops, farmers are anxious to get every advantage and every value possible from the commercial plant food.

Experiments show that proper application of these fertilizers is one of the best ways of accomplishing this. In the early days of commercial fertilizer, the theory was that, if the fertilizer was in the row, the plant or seed would get the value of it regardless of the proximity of the plant to fertilizer.

Today, the majority of farmers know this theory is wrong for two reasons: first, if the fertilizer is too far below the seedbed, the plant is not able to get the "quick send-off" it needs; and second, fertilizer placed too close to the seed is likely to burn or otherwise prove injurious to the best seed germination.

Farmers sometimes blame perfectly good fertilizer for poor crop yields, when in reality the blame should be placed on improper application.

Co-operative placement studies in Maine, the potato state, have shown the advantages of side application of fertilizer. A band of fertilizer on each side, about two inches away from and practically level with the seed piece, has generally proved to be the most efficient placement of fertilizer, according to Joseph A. Chucka, of the Maine Agricultural Experiment Station.

An interesting experiment with potatoes was made in Michigan in 1937 to determine the value of broken and continuous side bands of 4-12-8 fertilizer. At the 400-pound rate, the yield on the continuous band application was significantly better than the 4- and 8-inch bands. But when the broken bands were placed two

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inches from the seed, the yields equalled those from continuous band application.

Experiments involving different methods of applying fertilizer to tobacco have been conducted for several years at Oxford, North Carolina, Florence, South Carolina, and Tifton, Georgia. At Oxford, where the fertilizer was mixed with the soil in the row, the yield was 1,236 pounds of tobacco per acre, valued at $190. When the fertilizer was applied in bands two and one-half inches to each side and slightly below the root crown, the yield was 1,358 pounds per acre, valued at $259, according to H. R. Smalley, chief agronomist, National Fertilizer Association.

The practice of side dressing—distributing light applications of fertilizer to each side of the rows during cultivation—is increasing. This method has advantages in certan row crops; it gets the fertilizer to the crop at the time when it is small and needs it most, and minimizes the waste which occurs to some extent in the fertilizer placed at the time of planting.

Very striking results have been obtained on southern truck crops by side placement of fertilizer on snapbeans, spinach, kale, and other vegetable crops in Virginia. Experiments in the corn belt prove that the same advantages hold true with this crop.

Cotton yields have increased with side applications. Experiments at Rocky Mount, North Carolina, Columbia, Florence, and Clemson, South Carolina, Tifton, Georgia, and State College, Mississippi, all show an increase with side applications. In these experiments, the average yield of cotton without fertilizer was 527 pounds of seed cotton per acre. When 400 pounds 4-8-4 fertilizer was placed three inches under the seed, the yield was 863 pounds of seed cotton. When the same amount of fertilizer was applied in bands on each side of the row and two inches below the seed level, the yield was 901 pounds of seed cotton. When 800 pounds of fertilizer was applied under the seed, the yield was 916 pounds of cotton per acre.

But, when 800 pounds was applied at the sides of the row, the yield was 1,220 pounds a gain of 319 pounds for the side-applied additional 400 pounds of fertilizer as compared to 53 pounds increase with fertilizer placed under the seed.

Because of the prompt action of implement manufacturers in developing suitable machines and fertilizer depositing equipment, growers generally have been able to adopt this side application method to another advantage. That is, the method permits fertilizers and seed to be deposited at the same time.

After Twenty Years

Condensed from The Nation's Agriculture

Dick Crabb

WHITESIDE county is situated in the heart of the northwestern Illinois live stock belt. Some 2,500 farmers live within its 700 square miles, and most of them sell their grain and forage in the form of either milk or meat.

The need for better production methods brought about the organization of the Whiteside County Farm Bureau twenty years ago when some of these farmers—particularly the pork raisers—began to think of the value of the services of a county agricultural agent.

Its organization was completed February 2, 1918, with 347 charter members. Five months and five days later the county's first agricultural agent, J. S. Craig, of the University of Illinois, began work.

Roughly the 20-year history of the organization divides itself into three stages. In each case it has been changing economic conditions that have altered the course of the Bureau's program and steered it into another era. It is not to be supposed that the introduction of a new period has brought to a conclusion any of the important things which had been done before; rather, changes have amounted to a grafting on of new and more compelling objectives while the older ones have been quietly continued.

To understand the purposes of the newly formed Farm Bureau in 1918, it is only necessary to recall some of the early 1918 conditions. On the day that the Farm Bureau was organized, hogs sold at $16.60 in Chicago, farmers got as much as $30 a ton for clover hay, and in Minneapolis $1.75 was paid for No. 3 yellow corn. The United States was just getting its toehold in the Great War, and farmers were being entreated to wrest bigger crops from their acres, not as a matter of business, but as one of patriotic duty.

Naturally the emphasis was on production, and farmers were thinking in terms of crops and soils. The first year, the Farm Bureau sponsored a farmer tour to Urbana where the famous Morrow plots and other university experiment fields were located. The men were particularly interested in the increased production resulting from carefully planned crop rotations and in some of the newer crops being advocated for northern Illinois

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farms, one of which was alfalfa.

The war ended, but prices remained high and farming conditions generally good in 1919; and the program of the Bureau's activities continued practically unchanged until 1920. In that year the Farm Bureau launched a vigorous educational program to banish tuberculosis from Whiteside dairy herds. It was the first instance in which the new farm organization had taken a decisive stand on a newly recognized problem. Today its leaders point with pride to the work done in connection with the eradication of bovine tuberculosis.

It was in 1920 that the canopy of high prices and big margins, which had sheltered the Farm Bureau in its tender years, began falling away. Hardly had this condition developed before Whiteside farm leaders were discussing means of alleviating the situation. Their Farm Bureau gave them a new approach to problems of this sort and they meant to make use of it. The Farm Bureau enlarged its program to include a study of problems other than those of crop improvement and soil building, and a new stage in its history had begun.

Boiled down, the problem of the farmer was one of insufficient income. Either prices must be lifted or operating expenses must be cut. Unfortunately, prices of supplies and equipment hadn't retreated as rapidly or as much as the prices of things which they had to sell. It was this condition that turned attention to reducing the cost of things which contributed to high expenses of operation.

Several approaches to this new problem were considered, and it wasn't long until collective buying of farm necessities was started. Ventures in this field were launched and continued for a number of years. Although these early experiments conducted on a community or county scale did not prove to be everything that had been hoped for, they did furnish the incentive to build up the largest membership ever registered by the organization.

It was early in this lower-our-expenses or raise-our-income era that the state federation of Farm Bureaus, the Illinois Agricultural Association, began to muster enough support so that it could work effectively on problems overlapping county lines. The Whiteside County Farm Bureau had joined the I. A. A. late in 1919, and as early as 1921 circumstances indicated that the Farm Bureau could accomplish many things otherwise impossible by pooling its efforts with those of other counties through the medium of the state federation.

Organization of the Chicago Producers, co-operative live stock marketing agency, was one of the

first demonstrations of solving problems by application of this new procedure. For many years some of Whiteside's farmers had believed that commission firms at terminal markets had not been handling their business entirely in the best interests of live stock producers.

Accordingly, when a meeting was called in Chicago during June, 1921, Whiteside county was well represented.

The result of the Chicago conference was the organizing of the Chicago Producers, and the founders did not have long to wait before the farmer-controlled agency was pronounced a success by its foes as well as its friends. Starting from scratch in the early summer of 1922, Chicago Producers within a few years was handling as much live stock as any other commission firm in Chicago.

A technique in co-operation had been developed which farmers have been applying to difficult problems ever since. Collective buying of the things farmers use —insurance, gasoline, and paint —was not entirely successful until this mass attack was used.

By 1927 Whiteside farmers were buying car insurance from their own company, and since then similar services have been set for practically all other types of insurance. In 1931 a more decisive step was taken when the Whiteside Service Company was organized to distribute petroleum products, paints and other things generally used by farmers of the county. During the last year a million gallons of gasoline were bought by Whiteside farm operators from their Service Company.

In 1937 the Whiteside Farm Bureau established a chain of cold storage lockers to make community refrigeration facilities available to almost every farm family in the Whiteside area. Shortly after the first locker was built in Illinois, leaders of the Farm Bureau investigated the movement and found it to be of genuine interest to farmers. It was a new business, with no private business competitors; and it was a business that would be used almost exclusively by farm people. Hence, the Whiteside Co-operative Cold Storage Service was organized, and four plants were built during the summer and fall of 1937. It is the first county-wide co-operative-owned cold storage system in the country.

Let it not be thought that hammering down farm operating costs was the only project of the Whiteside County Farm Bureau from 1920 until 1931. L. O. Wise replaced Mr. Craig as farm advisor in 1921. Almost immediately he began introducing 4-H Club work in Whiteside county. A young assistant to Mr. Wise,

George Thiem, took an unusual interest in the new youth movement, and within two years 4-H activities in Whiteside county had attracted not only state-wide but national attention. In 1923 Mr. Thiem coached the Whiteside 4-H live stock judging team which won the national club contest and went to Europe where it met and defeated England's judging champions.

Until 1936 the Farm Bureau sponsored both boys' and girls' 4-H clubs, but in that year a Home Bureau was established in the county, and the new organization assumed the responsibilities of the girls' program. At present Whiteside county is among the first ten counties in Illinois in 4-H enrollment. Its agricultural clubs have set the pace in the state in the experimental work with hybrid corn, and girls' clubs are leaders throughout the area in health achievements.

The second era of the Whiteside Bureau's history was rapidly coming to a close in 1930 and 1931. Despite all that had been accomplished, prosperity had failed to return, and persistent economic adversity was at last working a change in the attitude of Whiteside farmers toward their problems.

For several years Whiteside Farm Bureau members had been advocating the use of the co-operative technique, found so effective in handling inter-county programs within the state, on a national scale to secure adjustments of problems overlapping state lines. They contended that the American Farm Bureau Federation offered state organizations the same opportunity in attacking a national problem that the Illinois Agricultural Association held out to the county Farm Bureaus in the meeting of a state issue.

Whiteside farmers were not the only ones who were thinking along these lines; agriculturists in distress throughout the entire nation were arriving at the same conclusions. It was this atmosphere of crisis that made possible the quick adoption of a new farm program early in 1933.

Looking back across the years it is seen that the crop improvement and live stock sanitation objectives of the Bureau's first period have been adhered to unceasingly ever since.

All of which indicates that Whiteside's Farm Bureau has been made up of conservative, clear-thinking farmers who have been slow to formulate programs until they were certain that such were consistent with the long range interests of the county's agriculture.

Selection of a Herd Sire

Condensed from Holstein-Friesian World

M. H. Campbell

THE methods of selecting herd sires have changed from time to time because the so-called tools with which we have to work have been improved. I was raised with a Holstein herd and can remember distinctly the time my father came home and announced that he had been able to purchase a young herd sire from a cow which had produced 30 pounds of butter in 7 days. It was supposed at that time that this was the only requirement necessary to be sure that the bull would transmit the right kind of production to his daughters. However, from sad experience he, as well as many another breeder, discovered that such a herd sire might well reduce the production of the herd through low producing daughters.

The next step was to change to a long time or yearly record with the argument advanced that this more nearly showed the producing ability of a cow. It was then felt that all that was necessary to have a good herd sire was to be sure that his dam produced about 800 to 1,000 pounds butterfat in a year. Many a breeder has learned since that such a record did not prove the transmitting ability of a bull to be what was expected.

Since 1900 the field of genetics has been developed. This field deals with the breeding or inheritance in animals, as well as plants. As the study advanced it was found that certain fundamental principles could be developed but some problems such as the inheritance of milk production were quite complicated and could not be readily solved.

Most dairymen are particularly concerned with the milk production of their herds so we will look at this one problem, although the principles involved in the study of it might just as well apply to type. It may be said that milk production is the result of two main factors—heredity and environment. As far as we are concerned these can be very definitely separated, for heredity has already played its part before environment has an opportunity to take effect. In other words, what an animal inherits from its parents is established at the time the individual is formed, which is the fertilization of the egg. After that environmental factors may affect the individual, although they are negligible until birth. After that

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an animal may not be able to reach its maximum inherited production if it is not properly fed, housed and managed.

It may be well to take a look into the mechanics of heredity. Figure 1 shows an unfertilized egg which is the female germ cell and a sperm which is the male germ cell. In these germ cells are bodies known as chromosomes which are represented by solid lines. This name is derived from the two words "chroma," meaning color, and "soma" meaning body. In other words, when these minute bodies are stained with a certain dye they will take on a dark color so they may be seen with the aid of a microscope. There are four chromosomes shown in each germ cell. This is the number ordinarily found in the fruit fly. A good deal of our work in genetics has been done with this fly and the principles developed there are applied to dairy cows. The fruit fly is used because it multiplies rapidly and has only the four chromosomes while the germ cell of the dairy animals contains 18 or 19 chromosomes.

The new individual is formed when the sperm enters the egg. The chromosomes of these two germ cells come together in pairs. this is always done in an orderly way so that like chromosomes pair up. During the life of the individual the cells of the body are made up with this double number of chromosomes but when the germ cells mature again nature has found a way to have these chromosomes divide so that the new germ cell formed will contain a reduced number, this being one-half the number in the body cell.

Because of the way the chromosomes behave in experimental breeding the geneticists have concluded that there are certain determiners on these chromosomes which control the character of the individual formed. These little determiners cannot be seen, but breeding experiments have proved their presence. Let us look at an example which will help clarify this point. One of the simplest characteristics which we can take is the coat color of the Holstein. As you know, the Holstein should be black and white but occasionally we have red and white individuals born. We can disregard the white and talk about the black and red colors alone. On one chromosome in each the male and female germ cell is a determiner for coat color. If in each case this determiner is for black the new individual formed gets two of them and thus is sure to have a black color and it will breed true for that color. If, on the other hand, we were working with Guernseys where each germ cell brought in a determiner for red the newly formed individual

would have this red color in double doses and would appear red. A third combination may be worked out where one of the parent germ cells carries the determiner for black and the other a determiner for red. This would be the case if we mated a Guernsey and a Holstein. The individual formed would have one determiner for the black and one for red in this case the animal itself would be black, for black color is what we call dominant over red. In other words only one color can appear and here the black color shows up. Such an individual will not necessarily breed true because it forms two kinds of germ cells. About fifty per cent of these germ cells would have the determiner for black while the other fifty per cent would have the determiner for red. If an animal forming such germ cells should be mated with another of the same make-up we might get either black or red offspring. In other words we might have an individual formed where by chance two determiners for black had come together, a determiner for black and one for red came together and where two determiners for red came together. In the first two cases the individual would be black while in the last it would be red. In making such matings the offspring appear in the ratio of about three blacks to one red. On this basis we can explain why we sometimes have red and white Holstein calves born. There is no secret in the fact that back in the origin of the Holsteins there were red and white animals. Thus when a breed was formed certain individuals carried this factor for red but appeared black. Such animals have been recorded in the Holstein-Friesian Association of America. When matings are made so that the germ cells of two such individuals come together we may have red and white calves born.

The above illustrations represent the simplest type of inheritance with which we can work. If other characteristics inherited in the same manner as coat color are added to the breeding trial the number of animals which must be raised to get the various possible combinations will increase rather rapidly. This is what we find in the case of inheritance of milk production. We do not know how many determiners are involved in this problem. It is certain that there are a fairly large number so that they cannot be separated out and studied individually by breeding experiments. However, we have been able to make a great deal of progress in the study of the inheritance of milk production by working with fairly large numbers of individuals.

Before leaving the individual

chromosomes I find it of interest to show how sex in the individuals is determined. A while ago I said that the germ cells of the dairy animal contained 18 or 19 chromosomes. The larger number of 19 is found in the case of the egg or the female germ cell. About half of the male germ cells or sperm contain 19 chromosomes while the other half contains 18. When an egg is fertilized by one of the sperm containing 19 chromosomes the individual formed will have 38 and will develop into a female. If the sperm with 18 chromosomes enters the egg we have only 37 in the new individual and it will develop into a male. Thus in the male we have one less than the even number of chromosomes. This theory of sex determination has been quite definitely proven and cannot be easily upset by some of the theories often advanced in practical breeding operations.

Now let us return to the inheritance of milk production. Figure 2 is used to graphically represent what might happen if we had dominant and recessive factors for this characteristic. I should make clear that this theory has not been proven and is only used as an illustration which may help to impress upon you the importance of present methods used in the selection of sires. In the chart I have represented the egg of an average producing female. Let us say that she has a determiner for milk production on each of four chromosomes. Two of these I have represented as dominant determiners which should produce 2500 pounds of milk. The other two are of the recessive type which would produce only 500 pounds of milk. The chart shows the individuals resulting by having such an egg fertilized by three types of sperm. The first has four determiners for the high production or 2500 pounds each. The resulting individual would then have an inherited capacity for 16,000 pounds of milk. The second individual is formed by sperm carrying four determiners for low production fertilizing the egg and resulting in an individual capable of producing 8000 pounds of milk. The third is an intermediate individual or the sperm has two high and two low determiners the same as was found in the egg which it fertilized. Thus this individual would have an inherited capacity to produce 12,000 pounds of milk in a year. You can readily see that a large number of individuals could be formed by making all the other possible combinations from sperm and egg each having four high determiners to those each having four of the low determiners.

It is not necessary to have three different sires represented to produce the three types of

sperm shown in the chart. Through the process of segregation and recombination of the various chromosomes in the life cycle of an individual it is possible to find the large number of sperm from one male showing the variation from the extreme from all high determiners to all low determiners. It is entirely a matter of chance which of these may fertilize the egg and therefore chance alone determines the inherited production of the individual formed. If such herd sires are used the offspring will very likely show a great deal of variation in production. Although on an average of a large number the production may be in the neighborhood of 10,000 or 12,000 pounds of milk yearly which is very satisfactory. If you are selecting a young herd sire where such a bull is being used you may run just as much risk of getting an animal which has inherited the capacity for transmitting low production as you would in getting one which might transmit high production. Therefore it is not desirable to select a young bull from a herd where such a sire is used. On the other hand we find herd sires which will transmit an average annual production of 10,000 to 12,000 pounds of milk a year to the daughters without having them vary more than 1000 or 2000 pounds of milk from this average. A young herd sire selected from such a sire is almost sure to have inherited this capacity to transmit average production and should give satisfactory results in a herd.

Now let us see how this information can be used when you are ready to buy a young herd sire. First you should get the pedigrees of prospects available. Naturally the seller will send you a pedigree but in most cases it will not give you all of the information you should have. Figure 3 shows the outline of a pedigree with the suggested information which you should ask for. First you should ask for complete information on the sisters to the bull. This will not be available unless the sire and dam are old enough to have offspring which should be in milk. In that case you would want to have the production of all the sisters on the sire's side. This might be listed under the sire. As brought out in the illustrations above, you can see that it is important to know the production of every one of the sire's daughters. Besides having the average you should ask for the variation from the high to the low daughters and if possible know the percentage of daughters which are above the average. You should then study the sisters of this prospective herd sire on the dam's side. The more of these maternal sisters which are producing the greater will be the in-

dication of the transmitting ability of the dam. The numbers of these sisters will not be so great but what you can ask for the individual records of each one. Some of them may be full sisters to the bull which makes the information more valuable. If you have several maternal sisters and 15 to 20 or more paternal sisters to the prospective herd sire which have production records and they represent all of the daughters which have come into milk it will not be necessary to go further in the study of this pedigree. However, it often happens that the sire and dam of the prospective herd sire are young so that they do not have producing offspring. In this case it will be necessary to go to the second generation and obtain exactly the same information as has been suggested for the sire and dam. Of course this is one generation further removed from the calf and there will be somewhat greater opportunity for these high production factors to be mixed with the low as they are passed through one more generation of ancestors.

Some may argue that you should go a step further in the study of this pedigree and compare the production records of the daughters of the sire of this bull with that of their dams, or in other words you should have a daughter-dam comparison and from that you can derive a bull index. There is no reason to argue against obtaining this extra information but at the present time there has not been enough massed testing to always make up daughter-dam comparisons in a pedigree.

Outline of pedigree showing what information should be secured in selecting a herd sire.

PROSPECTIVE HERD SIRE

Study all the maternal and paternal sisters as shown in the next generation.

SIRE

1. Number of registered daughters.
2. Number of tested daughters.
3. Average production of all tested daughters.
4. Amount of variation in production of daughters from the average.

GRANDSIRE

Secure same information as listed under sire.

GRANDDAM

Secure same information as listed under dam.

DAM

All production records.

All production records each of her daughters.

GRANDSIRE

Secure same information as listed under sire.

GRANDDAM

Secure same information as listed under dam.

You can see from the information desired that it is necessary for the breeds of dairy cattle to keep production records on every animal in the herd. That is why the herd test was started and has gradually been replacing the individual cow records in advanced registry. By keeping the herd in herd test year after year all of a bull's daughters to freshen should have production records. These records will be published by the association and the number of registered daughters of a bull can be obtained. If all the daughters have not been tested you may make a further check as to what has happened to see whether or not the poor ones have been culled before their production is known. If so it would be advisable not to take a young bull of that breeding because he might stand a chance of having these low production factors to transmit to his offspring.

After you have made a selection of the prospective herd sires from the production standpoint it is time to visit the herds where they are raised. Then you can make a study of the type of the sisters just the same as you have made a study of the production. If they have the desirable combination of type and production you want you should feel warranted in going ahead with that young bull. With all of this information you may not always get just what you expect but you will get desired results more than fifty per cent of the time which has ordinarily been the case in the past.

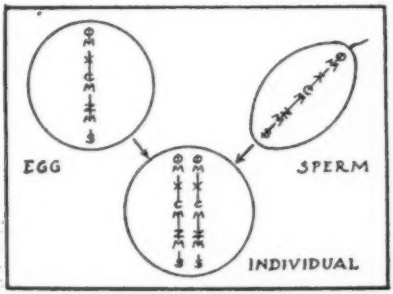

Fig. 1. Egg and sperm, female and male germ cells respectively, with the newly formed individual by their union.

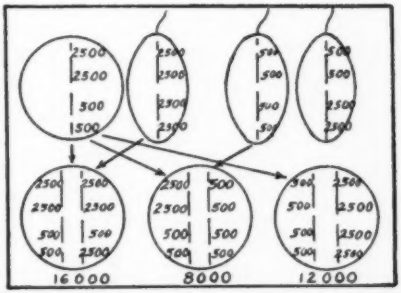

Fig. 2. Graphical illustration of what may happen if dominant and recessive factors for milk production are present.

Where We Stand on Electric Brooding

Condensed from Electricity on the Farm

I. P. Blauser

Extension Agricultural Engineering Specialist at Ohio State University, Columbus, O.

ELECTRIC brooding is no longer considered as an experiment. There is probably no better testimony for electric brooders than the growth of their use during the past five years. This is particularly significant because many of the first installations did not prove satisfactory for various reasons, the chief reason being the operator himself, while in a number of instances poor design and construction gave inferior results and costly operation.

There are two general types of electric brooders: the battery type brooder and the colony or hover type. The battery type brooder consists of several sections placed one above the other, so that a maximum number of chicks can be accommodated on a minimum of floor space. The use of the battery type brooder is confined very largely to commercial hatcheries in starting chicks or holding them until they are sold, but not to exceed two or three weeks, and to the so-called broiler factory, which raises broilers on a large scale with a minimum of space. The battery brooder has proved very satisfactory for those applications, but up to the present time has had only a very limited use in general brooding.

The hover brooder is the type that is used almost exclusively on farms. It is an individual brooding unit, with a heating element controlled by an automatic switch or thermostat, with various means for conserving the heat under the hover and supplying needed ventilation. The shape of the hover may be round, square, rectangular or oblong, and in most cases with the top slope of the hover steep enough to make it difficult for the chicks to roost on it.

Hover type brooders are further classified as: Electric lamp heated brooders, under-heat brooders, contact heat brooders, curtainless brooders, over-head heat brooders, and fan ventilated brooders. Each of these types of brooders has produced good results for some users, but not all have produced uniformly good results for a wide range of brooding conditions. A large percent-

Reprinted by permission from Electricity on the Farm, New York City

age of the brooders being sold at the present time are of the overhead heat type, either with or without fan ventilation. The heating elements may be either of the red heat or black heat type. The black heat type operates at a lower temperature, and there is only rarely a failure of these heating elements. If a red heat type of element is used, it is desirable to keep an extra element on hand, as they are more likely to burn out after several years of use. In cases of emergencies, high wattage light bulbs may be used temporarily.

Users of electric brooders and Agricultural Experiment Station workers have found that the electric brooder has a number of advantages over brooders using other types of heat. These advantages—of varying degrees of importance—have been given as: (1) Distinct saving in labor due to automatic control, and no handling of fuel or ashes. (2) Reliable automatic heat control regardless of change in weather. (3) Better chicks raised with less mortality. (4) Heavier growth at a given age of development. (5) Promotes early feathering of chicks. (6) Electric heat does not use up the oxygen of the air, or give off fumes. (7) Fire hazard reduced to a minimum. (8) With electricity at 3c per kilowatt-hour, compares very favorably with other heat.

The following have been given as disadvantages, or retarding influences to the more general use of electric brooders: (1) Poultrymen usually must change their methods and habits. (2) The high cost of a good, well designed, well built brooder. (3) High electric rates. (4) Moisture on floor and under hover. (5) Electric service might go off. A number of these difficulties have been practically eliminated and others have been greatly diminished during the past several years. Elecrtic rates have been reduced so that 3c electricity for brooding is available in many places; and the greater the use, the lower the rate. The continuity of electric service is now such that current outage is a very rare occurrence, and the service is still being improved. A power-off alarm is desirable to give a warning in case the power supply should go off for any reason. One of the several emergency measures can be taken to protect the chicks until the service is restored.

Electric brooders are now being used successfully in every section of the United States. Since the electric hover type brooder is designed to keep the space under the hover at the desired temperature with a minimum loss of heat, the brooder house stays cool. Thus electric brooding is quite frequently referred to as cool-room brooding. Only in ex-

tremely low temperatures is it desirable or necessary to supply auxiliary heat in the brooder house. Satisfactory results have been secured with outside temperatures below zero without auxiliary heat. It may be desirable, however, to have some auxiliary heat if the temperature gets down to 10 degrees above zero, unless extra precautions are taken to see that the chicks are kept comfortable.

No special type of brooder house is necessary for the electric brooder. The room, however, should be free from drafts, should have means for ventilation and the floor should be protected from underneath cold, even to the extent of using insulation on the floor if necessary.

In a number of cases excessive moisture under the hover, on the floor and on the walls, have been reported. Some electric brooders have more trouble than others, but usually the trouble can be remedied by proper ventilation of the hover and also of the brooder house, and by changing the litter somewhat oftener than with other types of brooders.

The cost of operation of the electric brooder is a factor in selecting a brooder. A number of things affect the operating cost per chick per season. The more important factors are these: (1) Design and construction of the brooder with emphasis upon insulation, ventilation, and curtains. (2) Time of year, outside temperature, hover temperature, and length of brooding season. (3) Brooder house, insulated floor, freedom from drafts. (4) Number of chicks brooded, and mortality (many authorities state that 300 chicks is the largest practical unit). (5) Electric rates. (6) The poultryman himself; management may make the difference between success and failure.

Records gathered from throughout the United States show that the average consumption of electricity for electric brooding varies from ½ to 1½ k.w.h. per chick per season, depending upon the factors mentioned above.

Good electric brooders, when properly managed, are producing high-quality chicks, with low mortality, and at a cost that compares favorably with other types of brooders. Since electric brooding has pretty well established itself, there seems to be a feeling on the part of many prospective purchasers that all brooders will give the same results regardless of the price of the brooder. The poorly insulated brooder may be lower in first cost, but higher in operating cost, and may not furnish sufficient heat for cool room brooding.

The electric brooder has eliminated much of the careful watching necessary with other brooders.

New Chemical to Control Peach Borer

Condensed from Farm Research

D. M. Daniel

FOR many years the standard material for control of the peach borer has been paradichlorobenzene used as crystals and placed in a ring around the tree to be treated. This method was laborious and time-consuming; it required very careful work to prevent injury to the tree; and for most effective control it had to be used just at the time when the grower was busiest with the harvest, and furthermore it could not be used on young trees.

More recently a liquid treatment was developed whereby paradichlorobenzene crystals were dissolved in cottonseed oil, emulsified, diluted with water, and sprayed directly on the base of the tree. It was possible to use the liquid treatment on all age trees without injury. This method eliminated a great deal of labor and was consequently much faster than the crystal-ring method. However, it still had to be applied at the growers' busiest season and the use of cottonseed oil made the cost for materials considerably higher, altho this was offset in large measure by lessened labor costs.

But now a new liquid treatment has been developed that seems destined to supplant all other methods. The killing agent employed is ethylene dichloride. It has been widely used in grain fumigation work for many years and the materials from which it is made are cheap and commercially available in large quantities. Ethylene dichloride is emulsified with potash fish-oil soap, diluted with water, and applied directly to any age peach tree.

Orchardists hail ethylene dichloride emulsion as a method which relieves them of the burden of peach borer control during the rush of harvest because it is effective at low temperatures; in fact it is more effective in cool weather than in hot weather and can therefore be used later in the fall than can paradichlorobenzene which requires a soil temperature of 60° F. or above to be effective. The ethylene dichloride emulsion has given excellent control in western New York when applied as late as the middle of November. It appears to be safer on young trees as well as more effective than paradichlorobenzene crystals. It has all the advantages of liquid application and it can be poured or sprayed with equally good results.

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Root Pruning Young Plants

Condensed from New Jersey Farm and Garden

THE question often arises among vegetable growers as to whether it pays to transplant young plants. Some growers have been in the habit of transplanting their young plants once, others twice a season and many others have not transplanted at all but have thinned the plants either in the row or where the seed was broadcast to allow the plants more room to expand.

In transplanting, the long roots of the plants break off when lifted from the soil, and giving the plants a different location enables them to develop new roots close to their bases. Transplanting, of course, is also done to allow more room for the plants to expand and grow to a larger size, but roots may be pruned without transferring the plants from their locations in the seed rows. There are two common methods of root pruning. One is cutting the roots with a knife and the other is lifting the plants just enough to break the long roots and then replace the plant in the same location.

When the roots are to be cut, plants such as tomatoes, peppers, egg plants and cabbage are allowed to attain a size of two or three inches. A sharp butcher knife is then run alongside the row at an angle, staying two inches away from the row and cutting off the roots at a distance of two to three inches under ground directly under the row. After one side of the row has been cut, water the plants thoroughly; then four or five days later cut the other side of the row in the same way. The long feeding roots will be cut off and the roots attached to the plant will quickly form new white feeding roots close to the plant base. Plants treated in this way should be thinned to stand not less than one-half to three-quarters of an inch apart in the row to allow for proper development of the roots and the separating of the plants when they are dug for field planting.

Root cutting is preferred by many growers to pulling, because it is quicker, easier and danger of damage to the plants is not so great.

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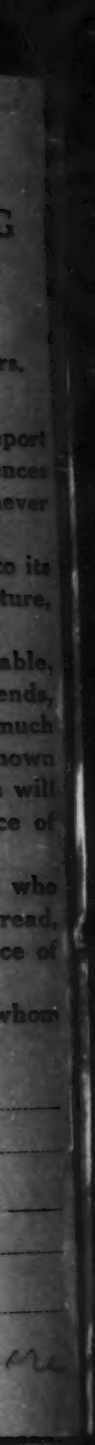
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